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ARCHITECTS & BUILDERS

PUBLISHED
UNDER THE AUSPICES
OF THE

Chicago Architects' Business Association

VOL. VIII, 1905

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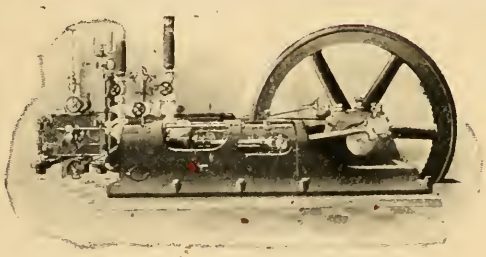

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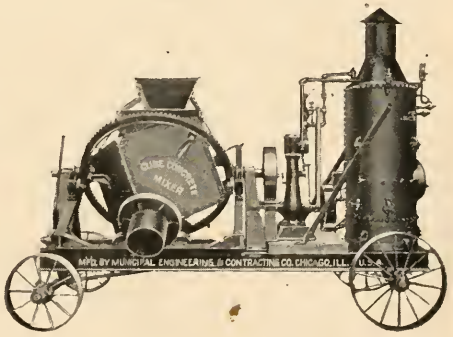

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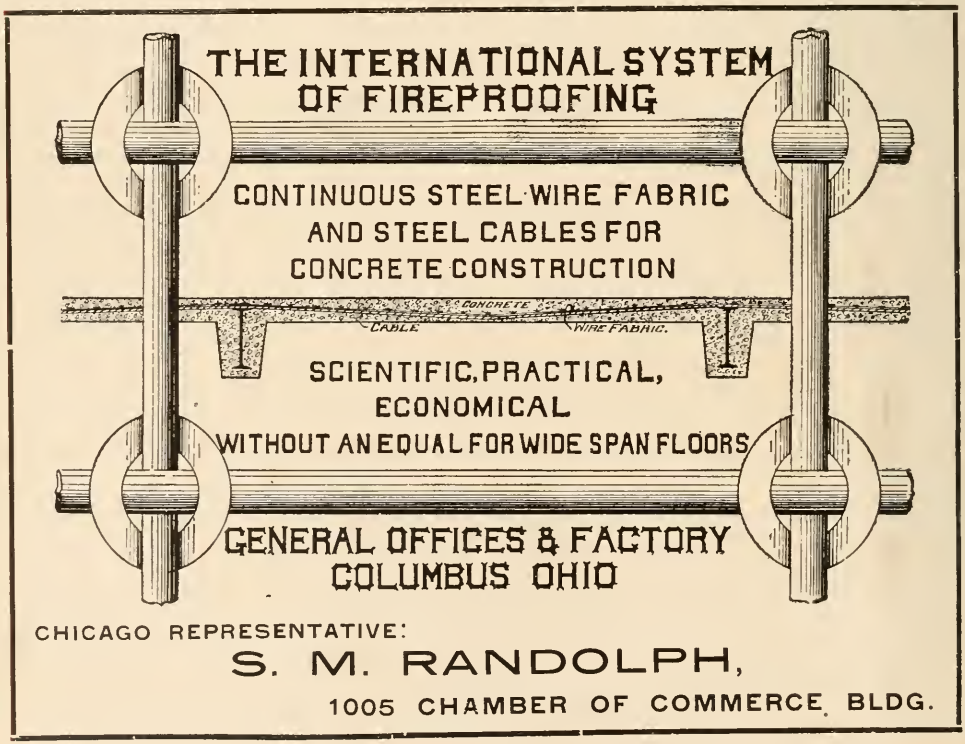

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HANDBOOK

FOR

ARCHITECTS AND BUILDERS

PUBLISHED UNDER THE AUSPICES

OF THE

Chicago Architects' Business Association

1905

EIGHTH YEAR

CHARLES R. ADAMS

EDITOR

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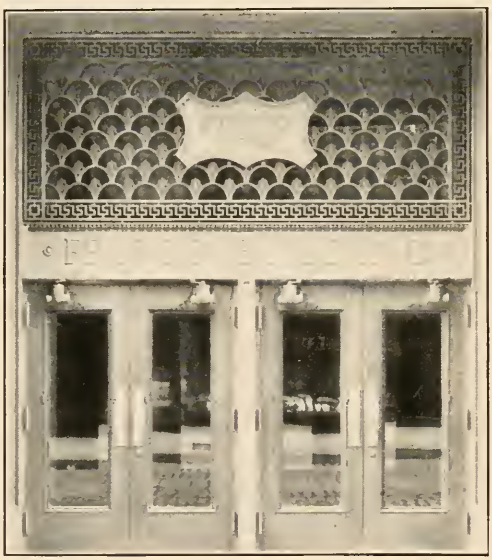

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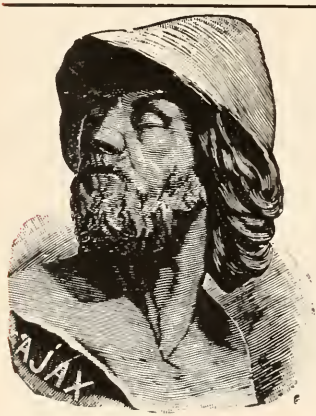

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PREFACE

THE last two issues of the "Handbook for Architects and Builders" have contained presages of a revised and remodeled Building Ordinance. Considerable time and thought have been expended in the production of one, and it is herewith presented:

Buildings have been rearranged under eight (8) classifications instead of five (5) as hitherto, and each class has been made as complete as possible within itself; references being given to the "General Provisions," etc., where requirements are such as to affect the classes severally.

The sections of the new ordinances are numbered as follows: From 1 to 99 cover the officers of the department, their appointment, duties, etc; 100 to 199 cover Class 1; 200 to 299 Class 2; 300 to 399 Class 3; 400 to 499 Class 4; 500 to 599 Class 5; 600 to 699 Class 6; 700 to 799 Class 7; 800 to 899 Class 8; 900 to 961 General Provisions; 962 to 964 Slow Burning Construction; 965 to 976 Mill Construction; 977 Ordinary Construction; 978 to 1056 General Construction requirements; 1057 to 1075 Frame Buildings; 1076 to 1093 Elevators and Hoistways; 1094 to 1104 Fire Escapes and Stand Pipes; 1105 to 1107 Fire Limits; 1108 to 1113 Frontage Consents; 1114 to 1123 Use and Obstruction of Streets for Building Purposes; 1124 to 1134 Billboards and Signs; 1135 to 1140 Storage of Oils; 1141 to 1161 Miscellaneous Provisions. In the Index the "general provisions" include the above sections from 900 to 1161 inclusive.

In the Municipal Code of Chicago, passed March 20, 1905, the ordinance appears under the heading CHAPTER 15, "Buildings," which is subdivided into 25 ARTICLES and numbered by sections from 199 to 738 inclusive, but for the convenience of Architects and others the new ordinance in this book is numbered by sections and indexed as above. The code numbers of sections will be found at the bottom of every page.

The classifications should be satisfactory, arranged as they have been by gentlemen highly qualified to know the requirements of the Architectural profession and of those equally interested in carrying out the building laws of the city.

It is convenient for the users of this book to refer from time to time to requirements regarding side-walk and vault covers, boiler and smoke inspection, State law relating to Fire Escapes, Department of Electricity, Gas-fitters' rules, Chicago Edison Company's System, the Act providing for the Licensing of Architects, the Mechanics' Lien Laws, ergo, these papers are again inserted.

The lists of city officials and other public bodies, together with the names and addresses of members of Architectural Societies and kindred associations revised to date of going to press are presented.

The miscellaneous information has been increased and an index to it compiled, which will be welcomed by the many searching for information among the several subjects treated.

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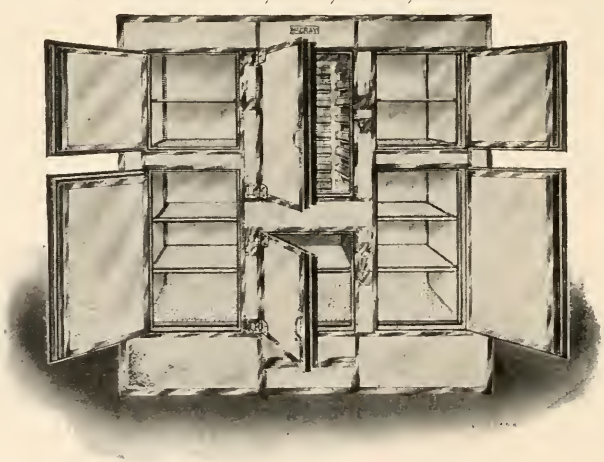

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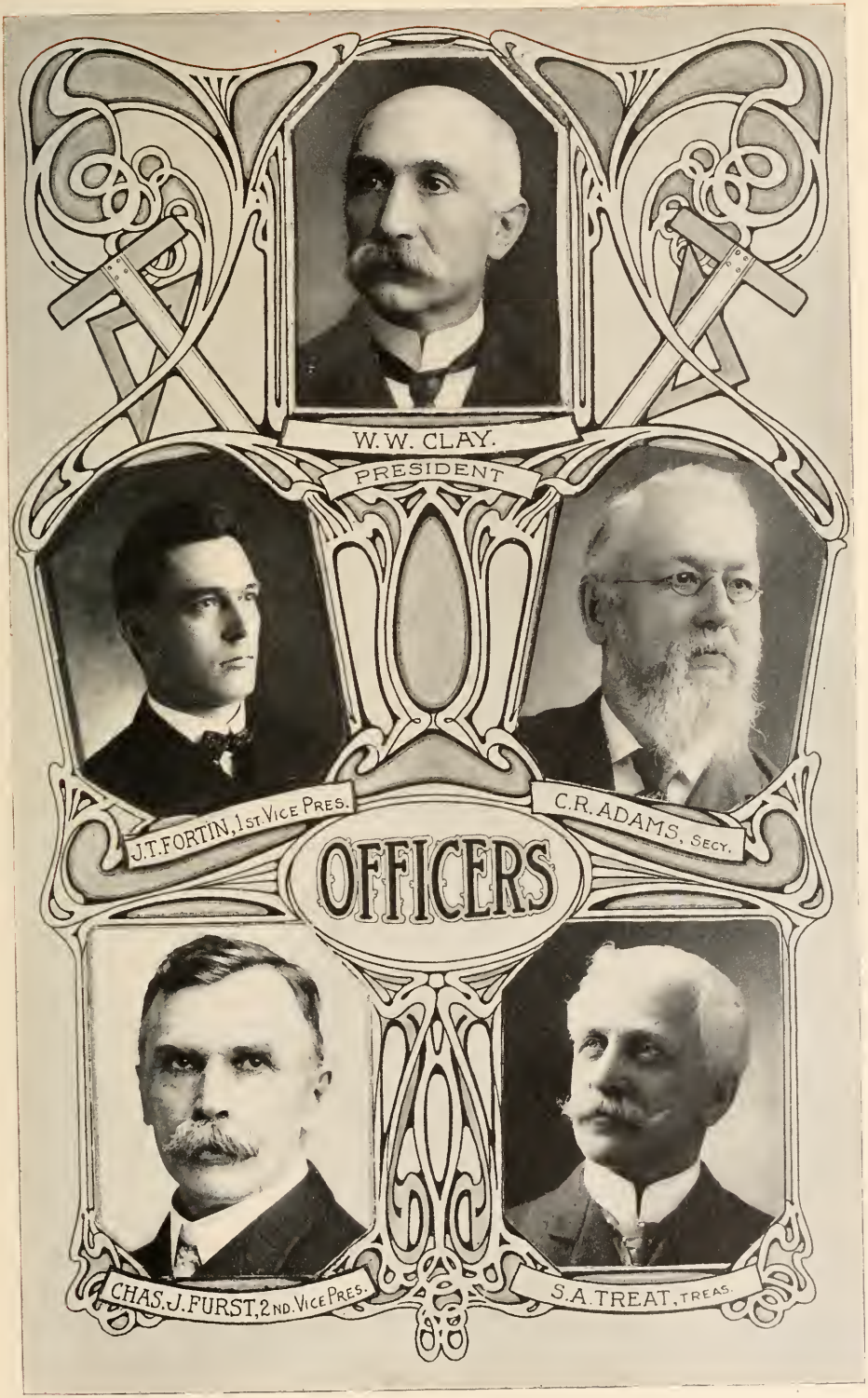
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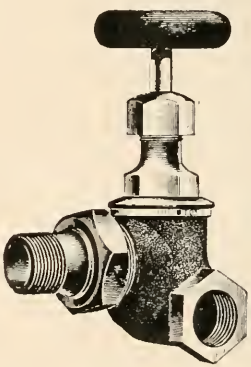

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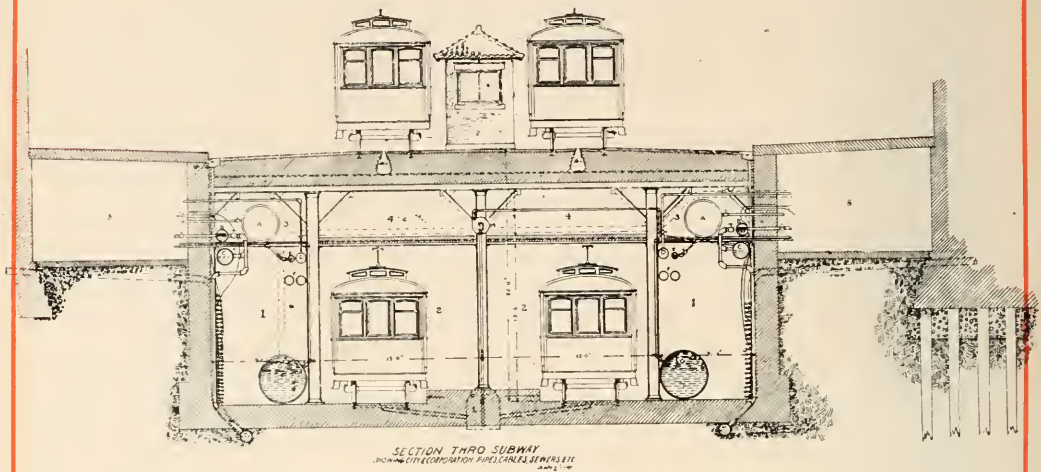

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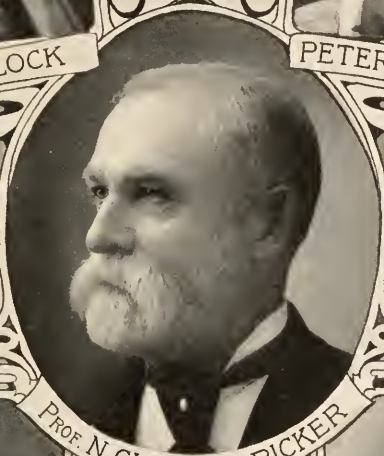

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On January 12th of this year the association entered upon the ninth year of its career, and more matters affecting the architectural profession and those businesses allied with it have been considered and consummated by it during the period of its existence than many readers are cognizant of. Would that every architect in Chicago were kindred, the advantages accruing would be paramount, and in the event of the profession acting as a unit, the position of every member of it would be strengthened and the public would be benefited by the consensus of opinion. The suggestion even of bringing together so large a body of trained experts may sound Utopian, but it is nevertheless practicable and would lead to incalculable results for good: that the words "trained experts" is used advisedly is evidenced from the last report issued by the Board of Examiners of Architects, which shows that of the 546 admitted to practice on the passage of the law to provide for the licensing of those qualified, 221 now stand revoked or are deceased. The examinations now necessary to qualify for admittance into the fold are such as to ensure a much higher standard of practical, scientific and artistic efficiency. To quote again from the examiners' last report, "there are now in force in the state 671 licenses of which 418 were granted under section 5 of the act, and 153 passed the board's examination under section 4."

At the memorable meeting held in Handel Hall on March 25, 1898, when more than 300 architects were present (a gathering unique in history), the object being "to obtain an expression of opinion and to take measures for effecting a permanent organization," it will be remembered that the late Mr. Dankmar Adler expressed the same ideas as hinted in this introduction, and a motion was proposed and carried, "that it is the sense of this meeting that the architects join the "Chicago Architects' Business Association." Many did join, and it is not too late to hope that the unaffiliated will aid by their counsel and presence in the furtherance of the above resolution; by so doing much could be accomplished and quarters suitable for the gathering together of the body politic could be obtained and such accommodations could be secured as to meet all exigencies, and place the hundreds of architects of Chicago in a position unequalled in the states.

With a view to bring the association more closely home both to its members and non-members, a synopsis of the work accomplished is inserted elsewhere, and while it does not cover everything attempted, it will, at least, demonstrate that the efforts put forward have been attended with successful and encouraging results, and will further evidence that small though its numbers may be, it still commands the respect of the community at large.

A revision of sections 36 and 145 of the building ordinance of 1898 referred to in last year's edition was submitted to the new ordinance committee, it was proposed to insert in section 36 "and the construction of all buildings or parts of

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buildings, and alterations or reconstructions erected from such plans shall be supervised by licensed architects," but it is to be regretted that the clause was not considered favorably. Section 145, relating to "dividing walls of class 1 (old ordinance)" was virtually adopted with slight change in its wording. See section 109 new ordinance.

It is learned that it is the intention of the officials of the building department to adhere strictly to the requirements of sections 43 and 44 (new ordinance) as to the drawing and stamping of plans, and, by the way, section 43 calls for the submitting of specifications with the plans, and this should be obligatory. If the authorities will strictly enforce sections 43, 44 and 45 it will do much to avert unfavorable criticism and will give the legitimate practitioner cause for satisfaction and thanks.

Since the last issue of this work very valuable papers have been read before the association, notably, "Woman's Industrialism," by Mr. W. W. Clay. Through "Spain and Italy," by Mr. Normand S. Patton. "What should be the main object of the association" general discussion. "The Concrete Building Block," Mr. A. L. Goetzmann. "Hospital Construction in American Cities and Towns, Sanitation, Ventilation, Lighting and Modern Methods," Mr. Meyer J. Sturm. "Flagstaff Architecture," Mr. S. A. Treat. "Asphaltum and Its Uses," Mr. J. S. Jackson. It is impossible to find space for the entire reporting of the above, but as much as could be crowded in has been printed. The new ordinances and index are much more lengthy than the old ones.

Reference may be made to the "Form of Contract" recommended by the association. It is used considerably and is growing in favor.

To meet the requirements of the clause on arbitration cited in the contract, a board of seven is appointed yearly, to any one of which matters in dispute can be referred. The names of the gentlemen selected are highly qualified to take up matters in dispute and their names are given in the list of officers.

The board of directors, public action and other committees are holding many sessions, and live questions are receiving very careful consideration leading up to action that will be of vital import not only to the profession but to the public at large.

During the session of the legislature just adjourned some important changes have been made in the "Act for the Licensing of Architects," and the attention of readers is directed to the amended act as printed in this issue.

In closing, mention is again made to the monthly meetings of the association which are not held without mental food being supplied in addition to the necessary provisions for the inner man. Architects are invited to partake of and enjoy both.

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RULES OF PRACTICE.

DRAWINGS.

Section 1. All drawings forming a basis for contracts shall be drawn to a scale of not less than one-eighth of an inch to the foot, in ink or by some other process that will not obliterate. General dimensions shall be accurately figured and the drawings made *explicit* and *complete.*

SCALE DRAWINGS.

Section 1. All portions of the work that require a larger scale to illustrate the same shall be drawn full size or to a scale large enough to make them fully set forth what is required by the Architect. No Architect shall ask for bids on any work until all general drawings are complete and sufficient details made, which in connection with the specifications will settle all questions affecting the cost of work.

SUPERVISION OF WORK.

Section 1. The supervision of an Architect shall be such as shall require the faithful execution of the work according to the true meaning and intent of the Plans and Specifications, but such supervision does not cover the duties of a clerk of the works. In case there is no clerk of the works provided by the Owner, Contractors must refer any questions about which there can be any doubt to the Architect for decision before proceeding to execute the work.

SPECIFICATIONS.

Section 1. Specifications must be prepared in ink or by some permanent process, and shall clearly explain the kind and quality of materials and methods of construction, and give such further information as may be needed to definitely supplement the Drawings.

Sec. 2. Everything that will be required in the work must be mentioned in the Specifications, as far as practicable, being classified and grouped under appropriate headings, and work called for by the Plans and not referred to in the Specifications, and vice versa, shall be included same as if mentioned by both Plans and Specifications, provided such work comes clearly within the branch or branches covered by the contract.

RULES FOR LETTING CONTRACTS.

Section 1. Written invitations for proposals will be forwarded Contractors for work to be let, stating when bids will be opened. This does not apply to public work requiring advertisement for proposals.

Sec. 2 Contractors desiring place upon the roster of an Architect's office shall furnish references as to *mechanical ability and fidelity* and be prepared to furnish a good and sufficient bond.

Sec. 3. Proposals shall be presented on the day set for opening of same, and will be opened in the presence of a representative of the bidders.

Proposals shall be opened, read and posted at the time specified before such bidders as are present. Contracts shall be awarded by Owners or Architects within a reasonable time thereafter.

Bidders shall not be held on proposals retained longer than ten days after date of opening.

Sec. 4. The lowest bidder will not be permitted to change the amount of his bid, but must sign contract or withdraw. The right is reserved to reject any or all proposals.

Sec. 5. If, after the opening of bids, changes are made in the Plans and Specifications amounting to not more than 10 per cent., the lowest invited bidder

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shall tender a detailed proposition for said changes, subject to the approval of the Architect and owner, and if found fairly detailed, the contract shall be awarded to him upon his bid so changed.

Sec. 6. Lack of ability to carry out the work in a proper manner, want of fidelity or disposition to render less than is due the Owner in strict conformity with the terms of contract, shall lay the Contractor liable to be dropped from the roster of the Architect, temporarily or permanently, as in the judgment of the Architect is just and right, and in the interests of his clients.

Sec. 7. Final certificates of payment on a contract shall not be issued by the Architect until the Contractor has returned all Plans and Specifications to the office of the Architect.

H. B. WHEELOCK, President.

Adopted September 9, 1897.

C. R. ADAMS, Secretary.

Schedule of Charges for Professional Services, Recommended by the Association.

For full professional services (including supervision) 5 per cent. upon the cost of the work, except as below stated.

For partial services in case of abandonment or suspension of the work, the charge is as follows: Preliminary studies, 1 per cent. General drawing and Specifications, 2½ per cent. Details, 1 per cent.

EXCEPTIONS TO ABOVE RATES AS BELOW.

Dwellings costing less than $10,000	7 per cent.
Dwellings costing more than $10,000	6 per cent.
In no case shall the fee for any dwelling be less than $150.	
Hospitals	8 per cent.
Factories	4 per cent.
Warehouses	4 per cent.
Additions and alterations to dwellings	10 per cent.
If less than $1,000	12 per cent.
Additions and alterations to business buildings	7 per cent.
Alterations to store fronts and store fittings	10 per cent.
Designs for furniture	15 per cent.
Designs for inside finish	10 per cent.
Monumental and wrought metal work	15 per cent.

An additional charge will be made for additions and alterations in plans and contracts in proportion to time expended.

Necessary traveling expenses to be paid by the owner.

The Architect's payments are successively due as the work is completed.

Until an actual estimate is received, the charges are based on the proposed cost of the works, and the payments are received as installments of the entire fee.

The Architect bases his professional charge upon the entire cost to the owner of the building, when completed, including all fixtures necessary to render it fit for occupancy, and all old materials used are to be reckoned in cost as if new.

An Architect's duties comprise:

The furnishing of all necessary drawings, specifications and instructions; the general supervision of work and the auditing of all accounts.

Drawings and specifications are the property of the Architect.

Where a special Superintendent or Clerk of Works is required, the expense is to be borne by the owner. He will remain at the works during its progress, and secure the proper fulfillment of the contract. He will be selected by the Architect, to whom he will report.

EXTRA SERVICES.

Consultation fees for professional advice are to be paid in proportion to the importance of the questions involved at the discretion of the Architect, and none of the charges above enumerated cover professional or legal services connected with negotiations for site, disputed party walls, right of light, measurement of work or services incidental to arrangements consequent upon the failure of contractors during the performance of the work.

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AN ACT

TO PROVIDE FOR THE LICENSING OF ARCHITECTS AND REGULATING THE PRACTICE OF ARCHITECTURE AS A PROFESSION.

Enacted by the Fortieth General Assembly at the Regular Biennial Session, Approved June 3, 1897, and in Force July 1, 1897; with Amendments Adopted by the Forty-first and Forty-fourth General Assemblies. In Force July 1, 1905.

Section 1. **Appointment of a State Board of Examiners of Architects.** — *Be it enacted by the People of the State of Illinois, represented in General Assembly,* That within thirty days after the passage of this act the Governor of this State shall, by the advice and consent of the Senate, appoint a State Board of Examiners of Architects, to be composed of five members, one of whom shall be a member of the faculty of the Illinois State University, and the other four shall be architects residing in the State of Illinois, who have been engaged in the practice of architecture at least ten years. Two of the said practicing architects appointed as examiners shall be designated to hold office for two years from the date of the passage of this act, and the other two, together with the member of the faculty aforesaid, shall hold office for four years from the passage of this act; and thereafter, upon the expiration of the term of office of the person so appointed, the Governor of the State shall appoint a successor to each person whose term of office shall expire, to hold office for four years, and said person so appointed shall have the above specified qualifications. In case appointment of a successor is not made before the expiration of the term of any member, such member shall hold office until his successor is appointed and duly qualified. Any vacancy occurring in membership of the board shall be filled by the Governor of the State for the unexpired term of such membership.

Sec. 2. **Examiners to file Oath of Office with the Secretary of State — Treasurer to file Bond—Salary of Secretary and Members of Board of Examiners.**—The members of the State Board of Examiners of Architects shall, before entering upon the discharge of their duties, make and file with the Secretary of State the constitutional oath of office. They shall, as soon as organized, and annually thereafter, in the month of January, elect from their number a president and secretary, who shall also be the treasurer. The treasurer, before entering upon his duties, shall file a bond with the Secretary of State, for such sum as shall be required of him by said Secretary of State, and in such form and with such securities as may be approved by the Governor of the State. The board shall adopt rules and regulations not inconsistent with this act to govern its proceedings, and also a seal; and the secretary shall have the care and custody thereof; and he shall keep a record of all the proceedings of the board

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which shall be open at all times to public scrutiny, and the board shall cause the prosecution of all persons violating any of the provisions of this act, and may incur necessary expenses in that behalf.

The secretary of the board shall receive a salary which shall be fixed by the board, and which shall not exceed the sum of fifteen hundred (1,500) dollars per annum; he shall also receive his traveling and other expenses incurred in the performance of his official duties. The other members of the board shall receive the sum of ten (10) dollars for each day actually engaged in this service, and all legitimate and necessary expenses incurred in attending the meetings of said board. Said expenses shall be paid from the fees received by the board under the provisions of this act, and no part of the salary or other expenses of the board shall be paid out of the State treasury. All moneys received in excess of the said per diem allowance and other expenses provided for, shall be held by the treasurer as a special fund for meeting the expenses of said board, and the cost of an annual report of the proceedings of the State Board of Examiners of Architects. And any moneys that may have been heretofore paid into the State treasury to the credit of said board are hereby appropriated to the said board, to be held by it as a part of said special fund; and the Auditor of Public Accounts is hereby authorized to issue a warrant for their repayment on the requisition of said board and the approval of the Governor, in such amounts as may from time to time be required.

Sec. 3. **Quorum Meetings of Board — Rules and Regulations.** —Three members of the board shall constitute a quorum. Special meetings of the board shall be called by the secretary upon the written request of any two members, by giving at least seven days' written notice of the meeting to each member, reckoning from the day on which the notices are postmarked, telegraphed or personally delivered. The board shall adopt rules and regulations for the examination of applicants for license to practice architecture, in accordance with the provisions of this act, and may amend, modify and repeal such rules and regulations from time to time. The board shall, immediately upon the election of each officer thereof, and upon the adoption, repeal or modification of its rules of government or its rules and regulations of examinations of applications for licenses, file with the Secretary of State, and publish in at least one architectural journal and one daily newspaper published in the State of Illinois, at least twice, the name and address of each officer, and a copy of such rules and regulations, or the amendments, repeal or modification thereof.

Sec. 4. **Examinations — Applicants for License to Pay a License Fee of $15 — License Fee, $25.**—Provision shall be made by the board hereby constituted for holding examinations, at least twice in each year, of applicants for license to practice architecture, and any person over twenty-one years of age, upon payment of a fee of fifteen dollars ($15) to the secretary of the board, shall be entitled to an examination for determining his or her qualifications. All examinations shall be made directly by said board, or a committee of two members delegated by the board, and due notice of the time and place of the holding of such examinations shall be published, as in the case provided for the publication of the rules and regulations thereof. The examination shall have special reference to the construction of buildings, and a test of the knowledge of the candidate of the strength of materials, and of his or her ability to make practical application of such knowledge in the ordinary professional work of an architect, and in the duties of a supervisor of mechanical work on buildings, and should also seek to determine his or her knowledge of the laws of sanitation as applied to buildings. If the result of the examination of any applicant shall be satisfactory to a majority of the board, under its rules, the secretary shall, upon an order of the board, issue to the applicant a certificate to that effect, and upon payment to the secretary of the board by the candidate of a fee of twenty-five dollars ($25), he shall thereupon issue to the person therein named a license to practice architecture in the State, in accordance with the provisions of this act, which license shall contain the full name, birth-place and age of the applicant, and be signed by the president and secretary, and sealed with the seal of

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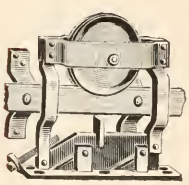

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the board. If an applicant fails to pass said examination his or her fee shall be returned.

All papers received by the secretary in relation to applications for license shall be kept on file in his office, and a proper index and record thereof shall be kept by him.

Sec. 5. **Architects Who are Entitled to License Without an Examination.** — Any person who shall, by affidavit, show to the satisfaction of the State Board of Examiners of Architects that he or she was engaged in the practice of the profession of architecture on the date of the passage of this act, shall be entitled to a license without examination, provided such application shall be made within six months after the passage of this act. Such license, when granted, shall set forth the fact that the person to whom the same was issued was practicing architecture in this State at the time of the passage of this act, and is, therefore, entitled to a license to practice architecture without an examination by the Board of Examiners, and the secretary of the board shall, upon the payment to him of the fee of twenty-five dollars ($25), issue to the person named in said affidavit a license to practice architecture in this State, in accordance with the provisions of this act. In the case of a copartnership of architects, each member whose name appears must be licensed to practice architecture. No stock company or corporation shall be licensed to practice architecture, but the same may employ licensed architects. Each licensed architect shall have his or her license recorded in the office of the county clerk in each and every county in this State, in which the holder thereof shall practice, and he or she shall pay to the clerk the same fee that is charged for the recording of notarial commissions. A failure to have his or her license so recorded shall be deemed sufficient cause for revocation of such license.

Sec. 6. **County Clerks to Keep Record of Licenses Recorded.**—Each county clerk shall keep in a book, provided for the purpose, a complete list of all licenses recorded by him under the provisions of this act, together with the date of the issuance of each license.

Sec. 7. **Licensed Architects to Have a Seal.**—Every licensed architect shall have a seal, the impression of which must contain the name of the architect, his or her place of business, and the words "Licensed Architect," "State of Illinois," with which he shall stamp all drawings and specifications issued from his office for use in this State.

Sec. 8. **Penalty for Practicing Architecture Without a License.**—After six months from the passage of this act it shall be unlawful, and it shall be a misdemeanor punishable by fine of not less than ten dollars ($10) nor more than two hundred dollars ($200) for each and every offense, for any person to practice architecture without a license in this State, or to advertise, or to put out any sign or card or other device which might indicate to the public that he or she is entitled to practice as an architect.

Sec. 9. **Persons Who Are to be Regarded as Architects.**—Any person who shall be engaged in the planning or supervision of the erection, enlargement or alteration of buildings for others, and to be constructed by other persons than himself, shall be regarded as an architect within the provisions of this act, and shall be held to comply with the same; but nothing contained in this act shall prevent the draftsmen, students, clerks of works or superintendents, and other employes of those lawfully practicing as architects, under license as herein provided for, from acting under the instruction, control or supervision of their employers; or shall prevent the employment of superintendents of buildings paid by the owners from acting, if under the control and direction of a licensed architect who has prepared the drawing and specifications for the building. The term building in this act shall be understood to be a structure, consisting of foundations, walls and roof, with or without the other parts; but nothing contained in this act shall be construed to prevent any person, mechanic or builder from making plans and specifications for, or supervising the erection, enlargement or alteration of any building that is to be

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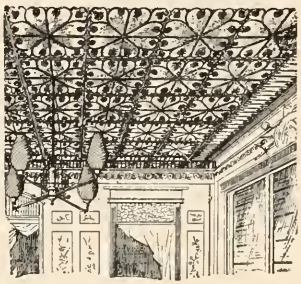

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constructed by himself or employes, nor shall a civil engineer be considered as an architect unless he plans, designs and supervises the erection of buildings, in which case he shall be subject to all the provisions of this act, and be considered as an architect.

Sec. 10. **License Revoked.**—Architects' licenses issued in accordance with the provisions of this act shall remain in full force until revoked for cause, as hereinafter provided. Any license so granted may be revoked by unanimous vote of the State Board of Examiners of Architects for gross incompetency, or recklessness in the construction of buildings, or for dishonest practices on the part of the holder thereof, but before any license shall be revoked such holder shall be entitled to at least twenty days' notice of the charge against him, and of the time and place of the meeting of the board for the hearing and determining of such charge. And on the cancellation of such license it shall be the duty of the secretary of the board to give notice of such cancellation to the county clerk of each county in the State in which the license has been recorded, whereupon the clerks of the counties shall mark the license recorded in his office canceled. After the expiration of six months from the revocation of a license, the person whose license was revoked may have a new license issued to him by the secretary upon certificate of the Board of Examiners, issued by them upon satisfactory evidence of proper reasons for his reinstatement, and, upon payment to the secretary of the fee of five dollars ($5).

For the purpose of carrying out the provisions of this act relating to the revocation of licenses, the board shall have the power of a court of record, sitting in the county in which their meeting shall be held, and the power to issue subpœnas and compel the attendance and testimony of witnesses. Witnesses shall be entitled to the same fees as witnesses in a court of record, to be paid in like manner. The accused shall be entitled to the subpœna of the board for his witnesses, and to be heard in person or by counsel in open public trial.

Sec. 11. **Renewal of Licenses.**—Every licensed architect in this State who desires to continue the practice of his profession shall annually, during the time he shall continue in such practice, pay to the secretary of the board during the month of July a fee of five dollars ($5), and the secretary shall thereupon issue to such licensed architect a certificate of renewal of his license for the term of one year. Any licensed architect who shall fail to have his license renewed during the month of July in each and every year shall have his license revoked; and it shall be the duty of the secretary of the board to give notice of such revocation to the county clerk in each county in the state, whereupon the clerks of the counties shall make an entry of such revocation accordingly.

But the failure to renew said license in apt time shall not deprive such architect of the right to renewal thereafter; and the secretary of the board shall give like notice of such renewal; but the fee to be paid upon the renewal of license after the month of July shall be ten (10) dollars, to cover the additional expense incurred by the board on account of such notices.

Sec. 12. **Report of Proceedings to be Filed with the Auditor of Public Accounts.**—Within the first week of December, after the organization of the board, and annually thereafter, the secretary of the board shall file with the Auditor of the State a full report of the proceedings of the board, and a complete statement of the receipts and expenditures of the board, attested by the affidavits of the president and secretary, subject to the approval of the State Auditor.

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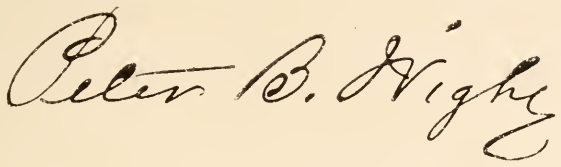

Secretary of the State Board of Examiners of Architects.

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Brooks, Thos. M., (care Deering Harvester Company).
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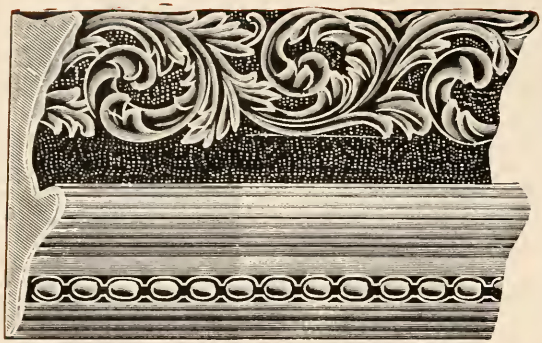

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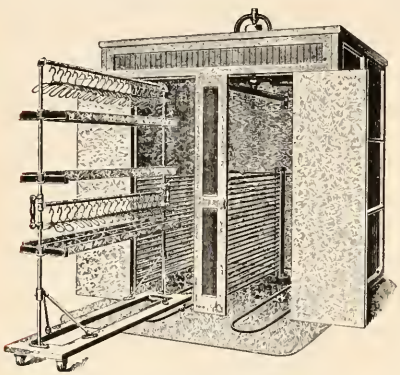

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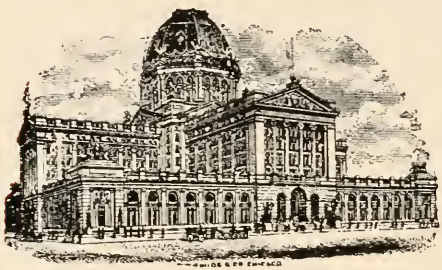

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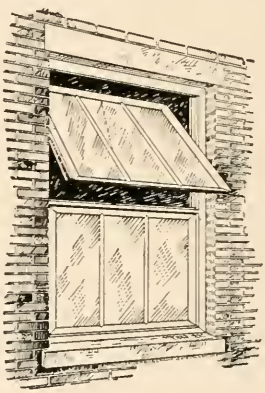

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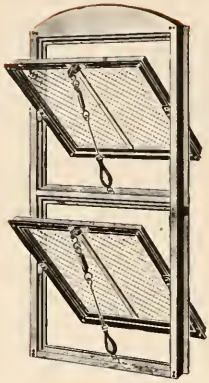
ABE MERINBAUM	
JOHN A. PLONER	Oil Inspector.
JAMES A. QUINN	City Sealer.
L. E. McGANN	City Comptroller.
LOUIS E. GOSSLIN	Deputy City Comptroller.
JOSEPH M. PATTERSON	Commissioner of Public Works.
W. M. O'CONNELL	Deputy Commissioner of Public Works.
FRED W. BLOCKI	City Treasurer.
A. C. ANSON	City Clerk.
WILLIAM CARROLL	City Electrician.
JOHN O'NEILL	Track Elevation Expert.
EDWARD M. LAHIFF	City Collector.
J. F. McCARTY	Deputy City Collector.
DR. A. R. REYNOLDS	Health Department.
FRANK X. BRANDECKER	Department of Supplies.
M. J. DOHERTY	Superintendent of Streets.
WM. QUINN (in charge)	Bureau of Sewers.
JOSEPH POWELL	Civil Service.
JOSEPH W. ERRANT	
CHRIS MEIER	
TIMOTHY J. CORCORAN	Secretary of Civil Commission.
GEORGE WILLIAMS	Building Commissioner.
FRANCIS O'NEILL	Chief of Police.
HERMAN F. SCHUETTLER	Assistant Chief of Police.
JOHN CAMPION	Chief of Fire Department.
EDGAR B. TOLMAN	Corporation Counsel.
WM. A. LEVERING	Supt. Water Pipe Extension Dept.
JOHN F. SMULSKI	City Attorney.
I. H. HIMES	Assistant City Attorney.
DR. HOWARD S. TAYLOR	City Prosecutor.
C. J. BUHMANN	Map Department.
HUGO GROSSER	City Librarian.
PATRICK WHITE	Superintendent of Bridges.
DR. J. F. TODD	City Physician.
H. O. NOURSE	Superintendent Bureau of Water.
ANDREW ROHAN	In Charge of Detective Department.
MICHAEL MADDEN	
WILLIAM LUMPP	Boiler Inspector.
JOHN C. SCHUBERT	Smoke Inspector.
EDWARD M. CUMMINGS	Gas Inspector.
HUGH GLEASON	President Board Examining Engineers.
A. J. MURRAY	Superintendent of Sidewalks.
P. L. HENDRICK	Chief of Sanitary Department.
EDWARD PRITCHARD	Secretary Health Department.
SIMON MAYER	Secretary of Police.
JOHN ERICSON	City Engineer.
ANDREW M. LYNCH	Board of Local Improvements.
JOHN MINWEGEN	
GEORGE SCHILLING	
PETER KIOLBASSA (President)	
JOHN A. MAY	Secretary Board Local Improvements.
FRANK SOLON	Superintendent of Streets and Alleys Cleaning Department.



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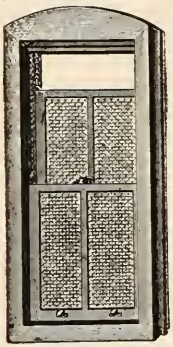

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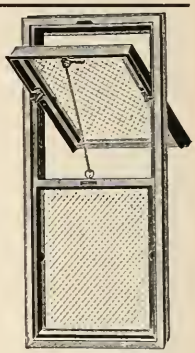

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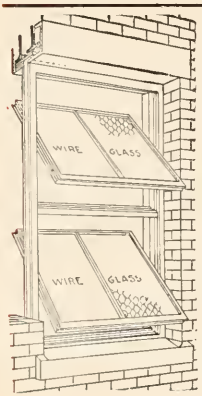

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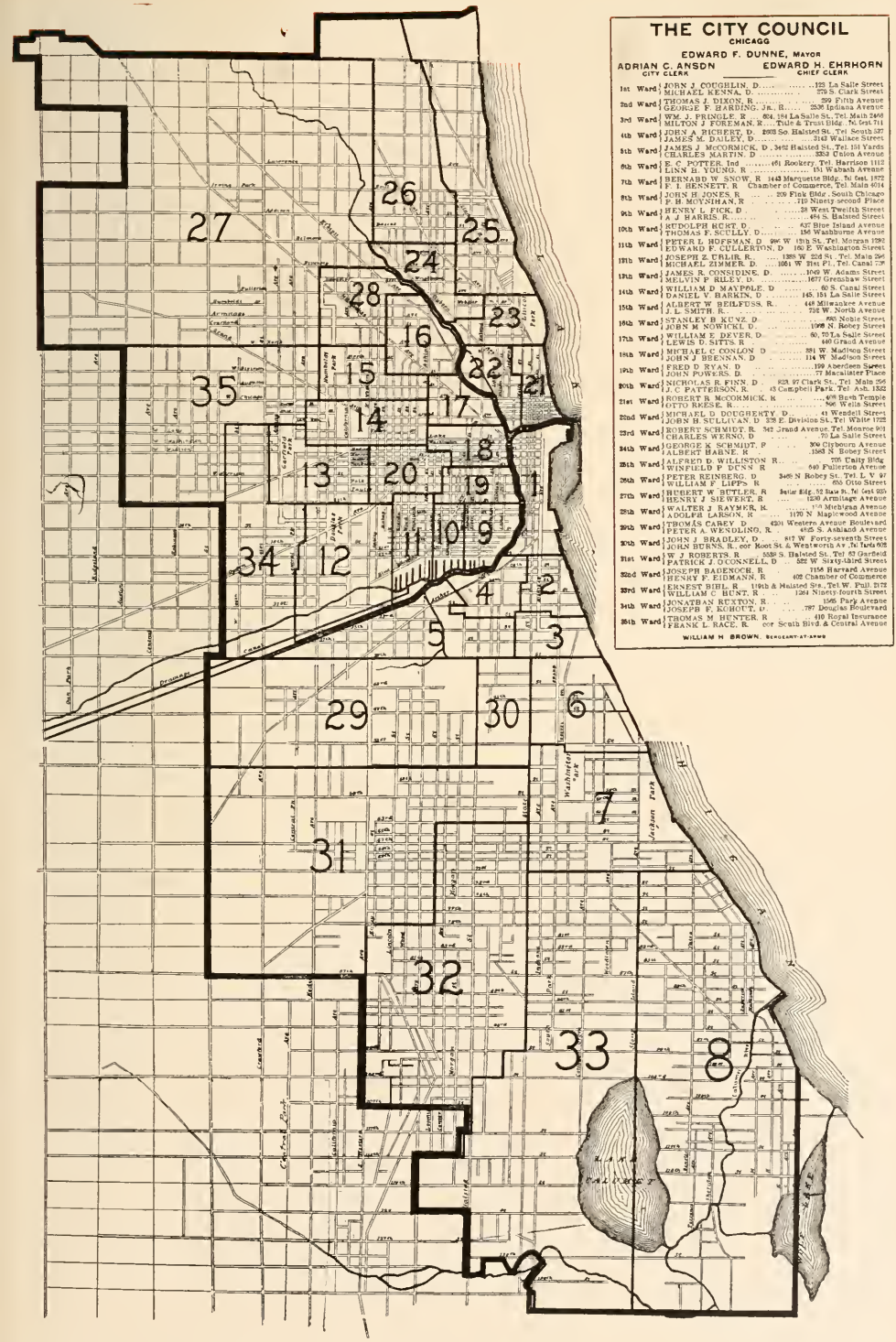

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CHICAGO

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	MILTON J. FORMAN, R	Title & Trust Bldg. Tel. Sct. 711
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	JAMES M. DAILEY, D	3142 Wallace Street
5th Ward	JAMES J. McCORMICK, D	3402 Halsted St., Tel. 151 Yards
	CHARLES MARTIN, D	3253 Union Avenue
6th Ward	E. C. POTTER, Ind	461 Rookery, Tel. Harrison 1112
	LINN B. YOUNG, R	151 Wabash Avenue
7th Ward	BERNARD W. SNOW, R	1443 Marquette Bldg., Tel. Sct. 1872
	F. I. BENNETT, R	Chamber of Commerce, Tel. Main 4074
8th Ward	JOHN H. JONES, R	209 Fisk Bldg., South Chicago
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9th Ward	HENRY L. FICK, D	28 West Twelfth Street
	A. J. HARRIS, R	404 S. Halsted Street
10th Ward	RUDOLPH HCHT, D	627 Blue Island Avenue
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11th Ward	PETER L. HOFFMAN, D	496 W. 13th St., Tel. Morgan 1290
	EDWARD F. CULLERTON, D	160 E. Washington Street
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	MICHAEL ZIMMER, D	1061 W. 21st Pl., Tel. Canal 776
13th Ward	JAMES R. CONSIDINE, D	1040 W. Adams Street
	MELVIN P. RILEY, D	1677 Grenshaw Street
14th Ward	WILLIAM D. MAYPOLE, D	60 S. Canal Street
	DANIEL V. BARKIN, D	145, 151 La Salle Street
15th Ward	ALBERT W. BELETUSS, R	448 Milwaukee Avenue
	J. L. SMITH, R	726 W. North Avenue
16th Ward	STANLEY B. KUCW, D	980 Noble Street
	JOHN M. NOWICKI, D	1098 N. Robey Street
17th Ward	WILLIAM E. DEVER, D	60, 70 La Salle Street
	LEWIS D. SITTS, R	440 Grand Avenue
18th Ward	MICHAEL C. CONLON, D	381 W. Madison Street
	JOHN J. HENNAN, D	114 W. Madison Street
19th Ward	FRED D. RYAN, D	199 Aberdeen Street
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	J. C. PATTERSON, R	43 Campbell Park, Tel. Ash. 1322
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	OTTO KREZ, R	506 Wells Street
22nd Ward	MICHAEL D. DOUGHERTY, D	41 Wendell Street
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32nd Ward	JOSEPH BADENOCH, R	7158 Harvard Avenue
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BRYAN LATHROP, Lincoln Park Board,	Old Colony Building.
HENRY G. FOREMAN, South Park Board,	108 Dearborn Street.
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MRS. FRANCES C. KENDRICK, Secretary Exhibition Committee,	196 Goethe Street.

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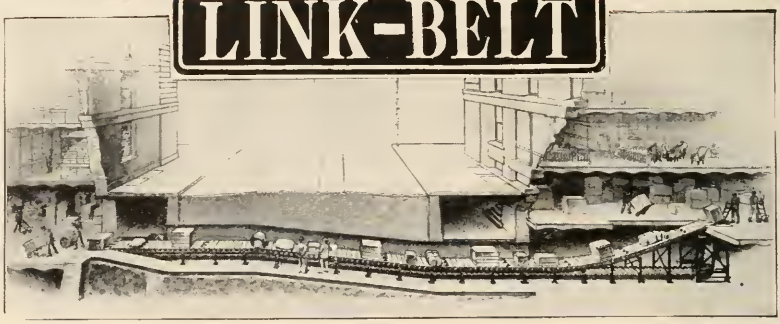

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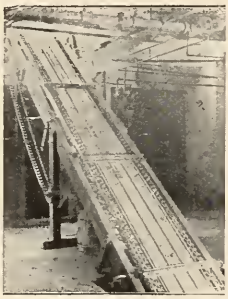

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BUILDING ORDINANCES OF THE CITY OF CHICAGO

As Passed March 13, 1905 and as Amended by the Revised Municipal Code Passed March 20, 1905.

The sections as herein numbered are in the same order as they appear in the ordinance of March 13, 1905 (see preface). The corresponding numbers used in the "Code" will be found at the bottom of every page.

CHAPTER FIFTEEN.

ARTICLE I.

OFFICERS—POWERS AND DUTIES.

Section 1. **(Department of Buildings Established.—Officers.)**—There is hereby established an executive department of the municipal government of the city, which shall be known as the Department of Buildings, and shall embrace a Commissioner of Buildings, a Deputy Commissioner of Buildings, an Assistant Deputy Commissioner of Buildings, a Civil Engineer, a Secretary to the Commissioner, a Chief Building Inspector, and such Inspectors of Elevators, Inspectors of Stand Pipes and Fire Escapes, and Inspectors of Buildings, and such other assistants and employes as the City Council may by ordinance provide.

Sec. 2. **(Building Commissioner.—Office Created.—Appointment.—Bond.)**—There is hereby created the office of Commissioner of Buildings. He shall be the head of said Department of Buildings, and shall be an experienced architect, civil engineer, builder, or competent building mechanic, and shall have been engaged in the city as an architect, civil engineer, builder or building mechanic for a period of ten years, and during his term of office as Commissioner of Buildings, he shall not be engaged in any other business.

He shall be appointed by the Mayor, by and with the advice and consent of the City Council.

Sec. 3. **(Bond.)**—The Commissioner of Buildings before entering upon the duties of his office shall execute a bond to the city in the sum of twenty-five thousand ($25,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 4. **(Powers.—Appointment of Subordinates.—Bonds.—Duties of Commissioner.)**—He shall have the management and control of all matters and things pertaining to the Department of Buildings, and shall appoint, according to law, all subordinate officers and assistants in his department and may remove them according to law. All subordinate officers, assistants, clerks and employes in said Department shall be subject to such rules and regulations as shall be prescribed from time to time by said Commissioner.

Sec. 5. **(Ordinances.—Enforcement of.)**—It shall be the duty of said Commissioner to enforce all ordinances relating to the erection, construction, alteration, repair, removal or the safety of buildings.

Sec. 6. **(Precautions in Behalf of Public Safety.—May Require Repair or Alteration in Such Cases.)**—It shall be the duty of the Commissioner of Buildings, when any citizen represents that ashes or combustible materials are kept in any place in the city in an insecure manner, or that the doors, stairways, corridors, exits or fire escapes in any factory or workshop or other place of employment are insufficient for the escape of employes in case of fire, panic or accident, or do not comply with the provisions of this chapter; or that the funnels, flues, fire boxes or heating apparatus in any building in the city are insecure or dangerous, or that any part of any building in the city

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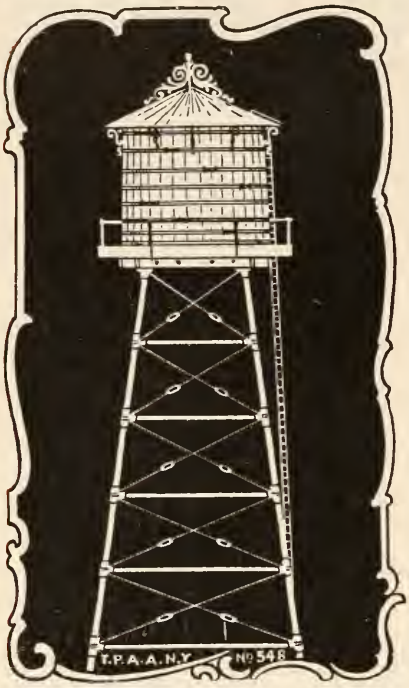

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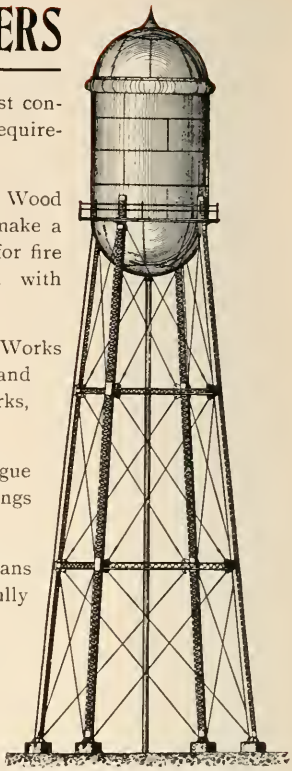

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is in an unsafe or dangerous condition, or in any wise in contravention of this chapter, to make an examination of such place of building, and if such representation is found to be true, said Commissioner shall give notice in writing to the owner, occupant, lessee or person in possession, charge or control of such place or building to make such changes, alterations or repairs as public safety or the ordinances of the city may require; and it shall be unlawful to continue the use of such building until the changes, alterations or repairs found necessary by the Commissioner of Buildings to make such building or part thereof safe or to bring it into compliance with this chapter, shall have been made.

Sec. 7. **(Inspection of All Buildings in General Use.—Must Report All Unsafe Conditions.)**—The Commissioner of Buildings shall inspect or cause to be inspected all public school buildings, public halls, churches, theaters and all buildings used either for manufacturing or commercial purposes, also all hotels, apartment houses and other buildings occupied by large numbers of people, for the purpose of determining the safety of such buildings, or any parts or appliances or equipment thereof; sufficiency of their doors, passageways, aisles, stairways, corridors, exits or fire escapes and generally their facilities for egress in case of fire or other accident, and the strength of their floors, and shall make returns of all violations of the several provisions of this chapter to the Law Department for prosecution.

Sec. 8. **(Interpretation of this Chapter.)**—The Commissioner of Buildings shall have full power to pass upon any question arising under the provisions of this chapter, subject to the conditions, modifications and limitations contained therein.

Sec. 9. **(Inspection of Elevators.—Power to Stop Use of Same.)**—The Commissioner of Buildings shall have power to prohibit and stop the use of any passenger or freight elevator when any Inspector of Elevators shall report to him that such elevator or the hoistway in which it is used is in a dangerous or unsafe condition. Such prohibition of use shall continue in force until such hoistway or elevator, or both, shall have been put in a safe condition, and certified to be safe after a proper inspection thereof by the Inspector of Elevators.

Sec. 10. **(Buildings Found in Unsafe Condition.—Notice to Owner.—Authority of Commissioner.)**—If the Commissioner of Buildings shall find in the city any building or structure or part thereof in such an unsafe condition as to endanger life, but so that, by the immediate application of precautionary measures such danger may be averted, he shall have authority, and it shall be his duty to forthwith notify in writing, the owner, agent, or person in possession, charge or control of such building or structure or part thereof to adopt and put into effect such precautionary measures as may be necessary or advisable in order to place such building or structure or part thereof in a safe condition. Such notice shall state briefly the nature of the work required to be done, and said Commissioner shall specify in such notice a time within which the work required to be done shall be completed by the person notified, such time to be fixed by said Commissioner upon taking into consideration the condition of such building or structure, or part thereof, and the danger to life or property which may result from its unsafe condition.

If the owner, agent or person in possession, charge or control of such building or structure, or part thereof, when so notified, shall fail, neglect or refuse to place such building or structure, or part thereof, in a safe condition, and to adopt such precautionary measures as shall have been specified by said Commissioner within the time specified in such notice, in such case, at the expiration of such time, it shall be the duty of said Commissioner to proceed forthwith to do, or cause to be done, any and all work necessary to place such building or structure, or part thereof, in a safe condition.

If the said commissioner shall be unable to find the owner of such building, structure, or part thereof, or any agent or person in possession, charge or control thereof, upon whom such notice may be served, he shall place or cause to be placed the notice herein provided for, upon such building at or near its principal entrance, and if, at the expiration of the time specified in such notice for the completion of the work required to be done the terms of such notice shall not have been complied with, it shall be the duty of the Commissioner to thereupon proceed and do such work in the same manner as has hereinbefore been provided in cases of refusal, neglect or failure on the part of the owner, agent or person in possession, charge or control of any such building, structure or part thereof, when so notified.

If, in accordance with the provisions of this section, the work of placing any building, structure, or part thereof in a safe condition shall devolve upon the said commissioner, and it shall appear that such building, structure or part thereof is in such a condition as not to warrant the expenditure thereon of a sufficient sum of money to make such repairs or to do such work as is necessary to put it in a safe condition,

7-8—203 9—204 10—205

the said Commissioner shall have authority to tear down or destroy such building or structure or part thereof, and the expense of tearing down and destroying any such building or structure or part thereof, and the expense of making any repairs or doing any work thereon shall be charged to the person owning or in possession, charge or control of such building or structure or part thereof, and the Commissioner shall recover or cause to be recovered from such owner or person in possession, charge or control the cost to the city of doing such work.

Sec. 11. (Building or Part of Building Constructed in Violation of Chapter.—Authority of Commissioner to Tear Down.)—If it shall be found that any building or structure or part thereof is being or shall have been constructed or built in violation of any of the provisions of this chapter, the Commissioner of Buildings shall forthwith notify the owner, agent, superintendent or architect of, or the contractor engaged in erecting such building or structure, or part thereof, of the fact that such building or structure, or part thereof, has been, or is being, constructed or erected contrary to the provisions of this chapter, and shall specify briefly in such notice in what manner the provisions of this chapter, or any of them, have been violated, and shall require the person so notified to forthwith make such building, structure, or part thereof, conform to and comply with the provisions of this chapter, specifying in such notice the time within which such work shall be done.

If, at the expiration of the time set forth in such notice, the person so notified shall have refused, neglected or failed to comply with the request made in such notice and to have such building or structure, or part thereof, concerning which notice was sent, changed so as to conform to and comply with the provisions of this ordinance, the Commissioner of Buildings shall have the authority, and it shall be his duty, to proceed forthwith to tear down or cause to be torn down such building or structure, or such part thereof as shall or may have been erected and constructed in violation of the provisions or any of the provisions of this chapter, and the cost of such work shall be charged to and recovered from the owner of such building or structure or from the person for whom such building or structure is being erected.

Sec. 12. (May Direct Fire Department to Remove.)—The Commissioner of Buildings shall also have authority to direct the Fire Department, after written notice has been served upon the owner, lessee, occupant, agent or person in possession, charge or control, personally, to tear down any defective or dangerous wall or any building or any part thereof which may be constructed in violation of the terms of this chapter. In case of the destruction, or partial destruction, of buildings by fire or by the action of the elements, when any department of the city government, pursuant to the ordinances of the city, shall make any outlay of money or incur any liability for the payment of any expense on behalf of the city in an effort to preserve or prevent the destruction of any such building or buildings, or for the preservation of the life or health of its citizens, it shall be the duty of the Commissioner of Buildings to ascertain the amount of such outlay or expenditure and present a bill therefor to the owner or owners of any such building or buildings, or his or their agent or agents, and it shall be the duty of the said Commissioner of Buildings to refuse to issue a permit for the reconstruction, alteration or repair of any such building or buildings by such owner or owners until such outlay or expenditure shall be repaid to the city by the owner or owners of such building or buildings so totally or partially destroyed in the manner aforesaid. Said Commissioner shall also proceed forthwith to collect from such owner or owners, by appropriate proceedings, the amount of such bill.

Sec. 13. (May Make Rules for Construction of Buildings and Control of Employes.)—The Commissioner of Buildings shall institute such measures and prescribe such rules and regulations for the control and guidance of his subordinate officers and employes as shall secure the careful inspection of all buildings while in process of construction, alteration, repair or removal and the strict enforcement of the several provisions of this chapter.

Sec. 14. (May Stop Construction.)—Said Commissioner shall have power to stop the construction of any building or the making of any alterations or repairs of any building within said city when the same is being done in a reckless or careless manner or in violation of any ordinance, and to order, in writing or by parole, any and all persons in any way or manner whatever engaged in so constructing, altering or repairing any such building, to stop and desist therefrom.

Sec. 15. (Arbitration Appeal from Decision.)—In cases where discretionary power to estimate damage to frame buildings is given the Commissioner of Buildings, as also in questions relating to the security or insecurity of any building or buildings, or parts thereof, and in all other cases where discretionary powers are, by ordinance, given to the Commissioner of Buildings, an appeal to arbitration shall be allowed

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to parties believing themselves injured or wronged by the decisions of the Commissioner of Buildings, as follows, to wit:

Sec. 16. **(Appeal.—Limit of Time of.)**—Any person wishing to make such appeal shall do so within five days after written notice of the decision or order of the Commissioner of Buildings has been given him. An appeal made later than five days after the serving of the notice of the Commissioner of Buildings shall not entitle the appellant to an arbitration. The request for arbitration shall be in writing and shall state the object of the proposed arbitration and the name of the person who is to represent the appellant as arbitrator.

Sec. 17. **(Appeal.—Cost of.)**—The Commissioner of Buildings shall thereupon state to the appellant the cost of such arbitration, and such appellant shall, within twenty-four hours from the time of filing the original request for arbitration, deposit with the Commissioner of Buildings the sum of money required for defraying the expenses of the same, which sum shall in each case be fixed by said Commissioner in proportion to the difficulty and importance of the case, but shall in no case be more than the cost of similar service in the course of ordinary business of private individuals or corporations. As soon as such sum of money shall have been deposited with him the Commissioner of Buildings shall appoint an arbitrator to represent the city, and the two arbitrators thus appointed shall, if they cannot agree, select a third arbitrator, and the decision of any two of these arbitrators shall, after investigation of the matter in question, be final and binding on the appellant as well as upon the city.

Sec. 18. **(Arbitrators to Take Oath.—Power to Examine Witnesses.)**—The arbitrators shall themselves, before entering upon the discharge of their duties, be placed under oath to the effect that they are unprejudiced as to the matter in question and that they will faithfully discharge the duties of their position. They shall have the power to call witnesses and place them under oath, and their decision or award shall be rendered in writing both to the Commissioner of Buildings and to the appellant from his decision. The fee deposited by the appellant with the Commissioner of Buildings shall be paid by the Commissioner of Buildings to the arbitrators upon the rendering of their report, and shall be in full of all costs incident to the arbitration; but should the decision of said board of arbitration be rendered against the Commissioner of Buildings, then the money deposited by the aforesaid appellant shall be returned to him, and the entire cost of such arbitration shall be paid by the city.

Sec. 19. **(In Urgent Cases.—Commissioner's Power Final.)**—Whenever the decision of the Commissioner of Buildings upon the safety of any building or any part thereof is made in a case so urgent that failure to properly carry out his orders to demolish or strengthen such building or part thereof may endanger life and limb, the decision and order of the Commissioner of Buildings shall be absolute and final.

Sec. 20. **(Duty of Police to Assist Commissioner in Enforcing Provisions of This Chapter.)**—Whenever it shall be necessary, in the opinion of the Commissioner of Buildings, to call upon the Department of Police for aid or assistance in carrying out or enforcing any of the provisions of this chapter, he shall have the authority so to do, and it shall be the duty of the Department of Police, or of any member of said Department, when called upon by said Commissioner, to act according to the instructions of, and to perform such duties as may be required by, said Commissioner in order to enforce or put into effect the provisions of this chapter.

Sec. 21. **(Certificates.—Notices.)**—The Commissioner of Buildings shall sign or cause to be signed all certificates and notices required to be issued from said Department, and keep a record of the same, and issue or cause to be issued all permits authorized herein.

Sec. 22. **(Must Keep a Register.)**—He shall also keep in proper books for that purpose a register of all transactions of the Department of Buildings, which such books shall be open to the inspection of the Mayor, Comptroller, Superintendent of Police, Fire Marshal and members of the City Council at all times.

Sec. 23. **(Must Keep Account of Fees Paid.)**—Said Commissioner shall keep, in proper books for that purpose, an accurate account of all fees paid, giving the name of the person paying same, date of payment and amount of each such fee.

Sec. 24. **(Annual Reports and Estimates.)**—He shall also annually, on or before the first day of February, in each year, prepare and present to the City Council a report showing the receipts and expenditures and entire work of his Department during the previous fiscal year, and he shall at the same time send to the Comptroller a full and comprehensive statement of all matters pertaining to his Department, together with an estimate in detail of the appropriations required by the Department during the current fiscal year.

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Sec. 25. **(Deputy Commissioner of Buildings.)**—There is hereby created the office of Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Deputy Commissioner of Buildings, he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

Sec. 26. **(Duties.)**—Said Deputy Commissioner shall pass upon all questions relating to the strength and durability of buildings; shall examine and approve all plans before a building permit is issued for the construction of any building or structure; shall supervise and have charge of all books and records and the various Inspectors employed in the Department of Buildings; shall receive, examine and file all reports made by them, and shall, under the direction and supervision of the Commissioner of Buildings, assign to such Inspectors the work they are to perform. He shall have a book or books in which shall be recorded the location and character of every building for which a permit is issued, and a copy of every report of inspection made for such building, so arranged that the full history of the various inspections of the building shall appear therein in consecutive order, with the name of each Inspector making the inspection thereof and the date of his report. He shall cause to be kept a record of all complaints of violations of the building ordinances, shall report the same to the Commissioner of Buildings, and shall cause all such complaints to be investigated. He shall act as Commissioner of Buildings in the absence of the Commissioner of Buildings from his office, and while so acting shall discharge all the duties and possess all the powers invested in or imposed upon the Commissioner of Buildings.

Sec. 27. **(Bond.)** He shall before entering upon the duties of his office execute a bond to the city in the sum of ten thousand ($10,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 28. **(Assistant Deputy Commissioner of Buildings.)**—There is hereby created the office of Assistant Deputy Commissioner of Buildings. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Assistant Deputy Commissioner of Buildings, he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

The Assistant Deputy Commissioner of Buildings shall, under the direction of the Commissioner of Buildings or the Deputy Commissioner of Buildings, assist and aid the Deputy Commissioner in the performance of his duties.

Sec. 29. **(Bond.)**—The Assistant Deputy Commissioner of Buildings, before entering upon the duties of his office, shall execute a bond to the city in the sum of five thousand ($5,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

Sec. 30. **(Secretary.—Duties.)** The Commissioner of Buildings shall appoint a Secretary, according to law, whose duty it shall be to preserve and keep, under the supervision and direction of the Deputy Commissioner of Buildings, all books, records and papers belonging to said office or which are required by law to be filed therein. The Secretary shall deliver to the City Council and to the respective departments all communications from said Commissioner, in writing, and perform such services as may be required by said Commissioner or Deputy Commissioner of Buildings.

Sec. 31. **(Chief Building Inspector.)**—There is hereby created the office of Chief Building Inspector. He shall be appointed by the Commissioner of Buildings according to law. Whenever the Commissioner of Buildings shall make requisition upon the Civil Service Commission of the city for a person to fill the office of Chief Building Inspector he shall notify the Civil Service Commission that the person certified to fill said office should be a competent civil engineer, architect or builder.

The Chief Building Inspector shall, under the direction of the Commissioner of Buildings, inspect and examine special cases of violations of the provisions of this chapter, damages to buildings by fire, the elements or accident of any kind whatsoever, and shall perform such other duties as may be required by the Commissioner of Buildings or the Deputy Commissioner of Buildings.

Sec. 32. **(Bond.)**—The Chief Building Inspector, before entering upon the duties of his office, shall execute a bond to the city in the sum of five thousand ($5,000) dollars, with such sureties as the City Council shall approve, conditioned for the faithful performance of the duties of his office.

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Sec. 33. (Inspectors.—Not to Engage in Business.)—The Inspectors of Buildings, after their appointment to office, shall not be engaged in any other business or vocation.

Sec. 34. (Inspectors.—Duties.—Reports.—How Made.)—The said Inspectors shall, under the direction of the Commissioner of Buildings, examine all buildings in the course of erection, alteration, repair or removal throughout the city at least once a week, or as often as may be required for securing efficient supervision, and shall make written reports to said Commissioner as to all violations of any ordinance of the city which the Department of Buildings is required to enforce, together with the street and number where such violations are found, the names of the owner, agent, lessee, or occupant thereof, and of architect, contractor and master mechanic, engaged in or about the construction of such building and all other matters relative thereto as far as they can ascertain them.

Sec. 35. (Report.—Must File Daily.)—Inspectors of Buildings shall file daily reports of their work of inspection, which shall be entered in the books to be kept for that purpose, and which shall be open to official inspection at all times.

Sec. 36. (Inspection.—Record of.—How Made.)—The said Inspectors shall examine all buildings and walls reported dangerous or damaged by fire or accident and make a record of such examinations, with the name of the street and number of the building and of the names of the owner, agent, lessee and occupant thereof.

Sec. 37. (Alteration, Enlargement or Raising.—Inspection of.)—The Inspectors of Buildings shall examine all buildings for which an application to raise, enlarge or alter has been made, and shall make a written report upon the condition of the same to the Commissioner of Buildings before the permit is granted.

Sec. 38. (Duties—Other.)—Said Inspectors shall perform such other duties as may be required of them by said Commissioner of Buildings, the rules and regulations of the Department of Buildings, or the ordinances of the city.

Sec. 39. (Powers—Other.)—The Commissioner and Deputy Commissioner of Buildings, as well as the Inspectors of Buildings and of Elevators, are empowered to enter any building, whether completed or in process of erection, for the purpose of determining whether the same has been or is being constructed in accordance with the terms of this chapter, and it shall not be lawful to exclude them from such buildings.

Sec. 40. (Elevator Inspectors.—Not to Engage in Business.—Duties.)—The Inspectors of Elevators shall not, after their appointment to office, be employed or engaged in any other business or vocation.

The Inspectors of Elevators shall perform such duties as may be required of them by the Commissioner of Buildings, the rules and regulations of the Department of buildings or the ordinances of the city.

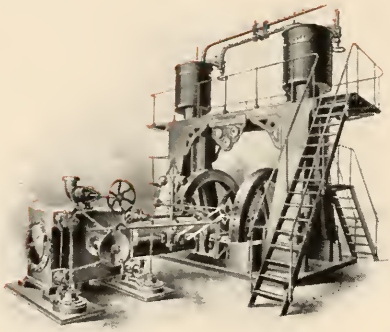
ARTICLE II.

PERMITS, PLANS AND FEES.

Sec. 41. (Permits.—When Required.)—Before proceeding with the erection, enlargement, alteration, repair or removal of any building in the city, a permit for such erection, enlargement, alteration, repair or removal, shall first be obtained by the owner or his agent from the Commissioner of Buildings, and it shall be unlawful to proceed with the erection, enlargement, alteration, repair or removal of any building or of any structural part thereof within the city unless such permit shall first have been obtained from the Commissioner of Buildings.

Sec. 42. (Permits.—Limitation of Time For.)—If, after a permit for the erection, enlargement, alteration, repair or removal of a building shall have been granted, the operations called for by the said permit shall not be begun within six months after the date thereof, or if such operations are not completed within a reasonable time, then such permit shall be void, and no operations thereunder shall be begun or completed until a new permit shall be taken out by the owner or his agent and fees as herein fixed for the original permit shall be paid for such new permit.

Sec. 43. (Permits.—Application For.—How Made.—How Recorded.—Stamped Plans.—How Cared For.—Return of Same.)—Application for such permits shall be made by the owner or his agent to the Commissioner of Buildings. When such application is made plans and specifications in conformity with the provisions of this chapter shall be filed with the Commissioner of Buildings, who shall then issue a permit, and shall file such application, and shall apply to such plans and specifications an official stamp, stating that the drawings and specifications to which the



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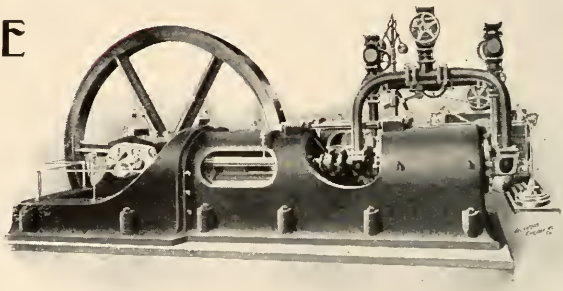

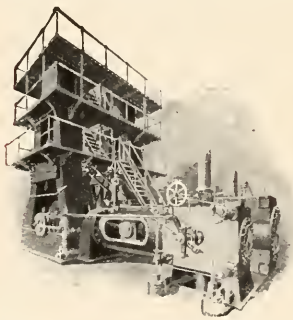

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same have been applied comply with the terms of this chapter. The plans and specifications so stamped shall then be returned to such applicant. True copies of so much of such plans and specifications as may be required in the opinion of the Commissioner of Buildings to illustrate the features of construction and equipment of the building referred to, shall be filed with the Commissioner of Buildings and shall remain on file in his office until the completion or occupation of such building, after which such drawings and specifications shall be returned by the Commissioner of Buildings to the person by whom they have been deposited with him upon demand. It shall not be obligatory upon the Commissioner of Buildings to retain such drawings in his custody for more than three months after the completion or occupation of the building to which they relate. The stamping of any plan shall not be held to permit or to be an approval of any violation of any section or provision of this chapter.

Sec. 44. **(Plans.—Essentials Of.)**—All such plans and drawings shall be drawn to a scale of not less than one-eighth of an inch to the foot, on paper or cloth, in ink, or by some process that will not fade or obliterate. All distances and dimensions shall be accurately figured, and drawings made explicit and complete, showing the entire sewerage and drain pipes and location of all plumbing fixtures within such building. Each set of plans presented shall be accompanied by a set of specifications describing all materials to be used in the proposed building, and both the plans and specifications shall be approved by the Commissioner of Buildings before a permit will be granted. No permit shall be granted or plans approved unless such plans shall be signed and sealed by a licensed architect, as provided in "An act to provide for the licensing of architects and regulating the practice of architecture as a profession in the State of Illinois," approved June 3, 1897. Provided, that permits may be granted for the erection of buildings of Class III., as hereinafter defined, if such building shall not be more than two stories in height and shall have a superficial area of not more than 1,250 square feet outside dimensions, on plans approved by the Commissioner of Buildings, which plans need not be signed by a licensed architect.

Sec. 45. **(Plans.—Alterations Upon Stamped Plans Not Permitted Without Permission.—Certain Alterations Excepted.)**—It shall be unlawful to erase, alter or modify any lines, figures or coloring contained upon such drawings or specifications so stamped by the Commissioner of Buildings or filed with him for reference. If, during the progress of the execution of such work, it is desired to deviate in any manner affecting the construction or other essentials of the building from the terms of the application, drawing or specification, notice of such intention to alter or deviate shall be given to the Commissioner of Buildings, and his written assent shall first be obtained before such alteration or deviation may be made. Alterations in buildings which do not involve any change in their structural parts or of their stairways, elevators, fire escapes or other means of communication or ingress or egress and that are not in violation of any of the provisions of this ordinance may be made without the permission of the Commissioner of Buildings.

Sec. 46. **(Deposit With Water Department.—How Made.—Indemnifying Bond.)**—Before the Commissioner of Buildings issues a permit as aforesaid he shall require evidence from the applicant that payment has been made to the Bureau of Water of the city for the water to be used or for a watermeter for measuring all the water to be used in the construction of such building, under the regulations of the Bureau of Water. Such applicant shall produce evidence that he has filed with and had approved by the Commissioner of Public Works of the City an indemnifying bond protecting the city against any and all damage that may arise to the streets or alleys upon which such building abuts, and to the city and to any person in consequence or by reason of the proposed operations to be authorized by such permit, or by reason of any obstruction or occupation of any street or sidewalk in and about such building operations.

Sec. 47. **(Fees for Water Used.)**—The fees to be paid for water used in connection with the erection of buildings shall be as follows, to wit:

For water to be used in connection therewith at the rate of five cents for every one thousand bricks, wall measure, used in the construction of a building.

At the rate of six cents for every one hundred cubic feet of rubble stone used in connection therewith.

At the rate of eight cents for every one hundred cubic feet of concrete used in connection therewith.

At the rate of fifteen cents for every one hundred yards of plastering used in connection therewith; and

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44—232 45—233 46-47—234

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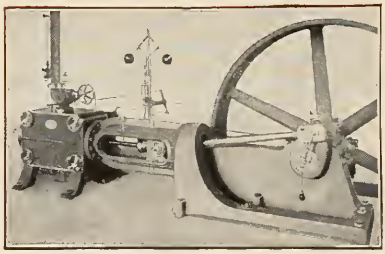

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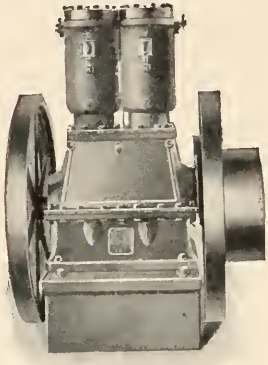

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Sec. 48. **(Permits.—Cost of.)**—The fees to be charged for building permits shall be as follows: For sheds not exceeding three hundred square feet in area, two dollars; for open shelter sheds, at the rate of fifty cents for each one thousand cubic feet or part thereof; but in no case shall a permit be issued for a less fee than two dollars.

For all buildings other than sheds and open shelter sheds, as hereinbefore described, the fee for the permit shall be at the rate of ten cents for every one thousand cubic feet or fractional part thereof contained therein, the cubic contents being measured to include every part of the building from the basement floor to the highest point of the roof and to include all bay-windows and other projections; but in no case shall any permit be issued for a less fee than two dollars.

Sec. 49. **(Permit for Alterations and Repairs.—Cost Of.)**—The fee to be charged for permits issued for alterations and repairs in or to any building or structure shall be as follows:

Where such alteration or repair shall equal fifty per cent. or more of the original building or structure to be altered or repaired, or of such part or portion of such building or structure to be altered or repaired, the same fees shall be charged as if such permit were for the construction of a new building.

Where such work of alteration or repair shall be less than fifty per cent. of the original building or structure or of the part or portion to be altered or repaired, the fee to be charged for a permit for such work shall be half that charged for the issuance of a permit for new work.

Sec. 50. **(Permit for Raising Wooden Building.—Cost Of.)**—The fee for a permit to raise a frame building shall be one dollar.

Sec. 51. **(Permits for Raising or Moving Buildings Other Than Frame.)**—The fee for a permit to raise or move a building other than a frame building shall be two ($2) dollars for every twenty-five (25) feet, or fractional part thereof, of frontage, and when such building is to be moved from one location to another it shall be altered or reconstructed so as to conform to the ordinances governing the construction of such building at the time of moving the same.

Sec. 52. **(Permit.—Revocation Of.)**—If work in, upon or about any building shall be conducted in violation of any of the provisions of this chapter, it shall be the duty of the Commissioner of Buildings to revoke the permit for the building operation in connection with which such violation shall have taken place. It shall be unlawful, after the revocation of such permit, to proceed with such building operations unless such permit shall first have been reinstated or reissued by the Commissioner of Buildings. Before a permit so revoked may be lawfully reissued or reinstated the entire building and building site shall first be put into condition corresponding with the requirements of this chapter, and any work or material applied to the same in violation of any of the provisions of this chapter shall be first removed from such building.

ARTICLE III.

CLASSIFICATION OF BUILDINGS.

Sec. 53. **(Buildings.—Classes Of.)**—All buildings (other than sheds and shelter sheds, as hereinafter described) now existing or hereafter constructed, altered or enlarged within the city, shall be classified as follows:

Sec. 54. **(Class I.)**—In Class I. shall be included every building used for the sale, storage or manufacture of merchandise, other than department stores, as described in Sections 60 and 70 of this chapter, and all stables covering or occupying a ground area of over five hundred square feet.

Sec. 55. **(Class II.)**—In Class II. shall be included every office building, hospital and every building used for hotel purposes or for boarding or lodging house purposes where such building so used for hotel or boarding or lodging house purposes is occupied by twenty or more persons.

Sec. 56. **(Class III.)**—In Class III. shall be included every building used as a family residence, also every building used for stabling purposes where such building so used shall occupy a ground area of less than five hundred square feet.

Sec. 57. **(Class IV.)**—In Class IV. shall be included every building used as an assembly hall, whether such hall is used for the purpose of worship, instruction or entertainment, unless such building is used for any of the purposes for which buildings of Class V. or Class VIII. are used.

Sec. 58. **(Class V.)**—In Class V. shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery

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is used; provided, however, that public halls and club halls with a seating capacity of less than six hundred, although occasionally used for theatrical representations, shall not be construed to be public theaters within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stage thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V. as herein defined. Such public halls and club halls shall be included in Class IV., as defined in Sections 57 and 400 of this chapter.

Sec. 59. **(Class VI.)**—In Class VI. shall be included every tenement and apartment house; that is to say, any house or building or portion thereof which is used as a home or residence for two or more families living in separate apartments.

Sec. 60. **(Class VII.)**—In Class VII. shall be included all buildings used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as "department stores."

Sec. 61. **(Class VIII.)**—In Class VIII. shall be included every building used exclusively for school purposes.

Sec. 62. **(Buildings Used for the Purposes of More Than One Class.)**—Where any building is used for the purposes of two or more classes as herein specified and defined, such portion of any such building as is devoted to the uses and purposes of any particular class shall be constructed, operated and maintained in accordance with the requirements of this ordinance relating to such class, unless such construction shall prove impracticable or unless there would be a conflict between the provisions of this ordinance relating to the construction of buildings; in either of which such cases the provisions relating to and governing the construction of buildings of the class requiring the best and safest form of construction shall govern.

Sec. 63. **(Conflict Between Special and General Provisions.)**—Whenever any provision or requirement of this chapter relating specifically to the construction, equipment, maintenance or operation of any building or part of a building used for the purposes of any specified class shall conflict with the general provisions of this chapter relating to the construction, operation and equipment of buildings generally, the special provisions shall govern in each case, except in the case of section —, which shall govern in all cases coming within its provisions.

ARTICLE IV.

PROVISIONS RELATING SOLELY TO CLASS I.

Sec. 100. **(Class I.)**—In Class I. shall be included every building used for the sale, storage or manufacture of merchandise other than department stores, as described in Sections 60 and 700, and all stables covering or occupying a ground area of over five hundred square feet.

Sec. 101. **(Walls of Class I.—Thickness Of.)**—The thickness of surrounding walls and of all dividing walls in every building used wholly or in part for the purposes of Class I. shall be made as indicated in the following table, to wit:

		STORIES										
	Basement.	1	2	3	4	5	6	7	8	9	10	11	12
One-story	12	12											
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

Provided, however, in buildings of steel skeleton fireproof construction thickness of walls shall be governed by Section 911.

Sec. 102. **(Buildings.—Height and Construction Of.)**—Buildings of Class I. which are one hundred feet or more in height shall be built entirely of fireproof construction.

Buildings of Class I. less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning, mill or fireproof construction.

No building of Class I. more than five stories in height shall be permitted to be built of ordinary construction.

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Sec. 103. **(Walls.—Exception to Table of Thickness Of.)**—If buildings of Class I. are erected of less depth than 100 feet from front to rear or between cross walls, or if the walls supporting their floors and roofs are less than twenty-five feet apart, the thickness of the walls given in the aforesaid table may be reduced by four inches, excepting only that no wall in such buildings shall be less than twelve inches thick.

Sec. 104. **(Walls.—Metal, Lath and Solid Cement Plaster Covering.)**—A one or two-story building used for the purposes of Class I., no part of which is within twenty feet of any lot line, alley line or street line, having a complete self-supporting steel frame consisting of wall columns supporting steel trusses, with steel trusses and steel diagonals designed to resist safely within the safe limits of stress provided by this chapter a wind pressure of thirty pounds per square foot for each and every exterior surface exposed to the wind, in addition to the dead weight of the completed structure and in addition to the live load of one hundred pounds per square foot provided for by this chapter and any other live loads which may be imposed on said structure, may have exterior walls measuring not less than one and one-third inches thick of metal, lath or metal fabric plastered on both sides with a mortar consisting only of Portland cement and torpedo sand. A complete reinforced concrete framework built in every manner equally as strong and as safe as provided for a steel frame in this section may have exterior walls built in the same manner of the same materials and of the same thickness.

Sec. 105. **(Door Openings at Street Level.—Class I.)**—The aggregate width of door openings at the street level in buildings of Class I. shall be equal to the aggregate width of stairways, as specified in Section 115 of this chapter, and such doors shall not be locked during business hours or while such buildings are occupied by a number of persons for any purpose. Revolving doors shall not be considered as complying with this section.

Sec. 106. **(Buildings of Class I.—Increasing Height Of.)**—In all cases where buildings of Class I., of ordinary construction, already built, are to be increased in height above the height of sixty feet or above the height of one hundred feet, the additional parts of such buildings shall be constructed as herein provided for buildings over sixty feet high or over one hundred feet high, respectively, and shall be made to conform in all respects and throughout their entire extent to the requirements for buildings of this class more than sixty feet or more than one hundred feet high, respectively, before it shall be lawful to occupy them.

Sec. 107. **(Ceilings and Roof of Class I.—Space Between.)**—In buildings of Class I., if the inclosed space between the ceiling and the roof is of greater average height than two feet, easy and convenient means of access, satisfactory to the fire marshal, shall be given to such space.

Sec. 108. **(Fire Walls.—In Buildings of Class I.)**—Buildings occupied by more than one person or corporation, or for more than one business enterprise conducted by the same person or corporation, in separate inclosures on any one floor, shall have a brick dividing wall for every fifty (50) feet of street frontage if of ordinary construction, or for every eighty (80) feet of street frontage if of slow-burning or mill construction, and such dividing walls shall extend from the front to the rear wall, and such dividing walls, and the doors therein shall be built as dividing walls, and the doors therein are required to be built by the provisions of this chapter.

All of the partitions between the parts of such buildings, occupied by different persons or corporations shall be built of incombustible material from the floor to the floor boards or roof boards next above such story or stories so occupied.

Only metal framed windows glazed with one-quarter inch thick fire-resisting glass may be used in such partitions.

Sec. 109. **(Dividing Walls.—When Required in Class I.)**—Dividing walls will be required in buildings of Class I. as follows: For buildings of ordinary construction if their floor area exceeds nine thousand square feet; for buildings of slow-burning or mill construction more than one story in height if their area exceeds twelve thousand square feet; for fireproof buildings more than two stories in height, if their area exceeds twenty-five thousand square feet. In each of the before mentioned cases such buildings shall be subdivided by brick walls built of the thickness given in the table for the thickness of inclosing walls, and all doors and other openings in such walls shall have iron doors or shutters at each side of same. The buildings so subdivided shall be treated as regards stairs and fire escapes the same as two or more separate buildings, provided, however, one-story buildings of ordinary, mill or slow-burning construction or two-story buildings of fireproof construction of any size, used as one store, room or workshop and occupied by only one person or corporation, may be erected without any dividing walls.

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Sec. 110. **(Dividing Walls and Iron Doors.—Openings Inserted In.)**—If openings are to be inserted in dividing walls, as before described, or in dividing walls between non-fireproof and fireproof buildings or parts of either of such buildings, they shall be made as follows:

They shall have doors placed on each side of each opening in such walls, which doors shall be made of No. 12 plate iron with a continuous 2 by 2 by one-half-inch angle iron frame extending all around the same and the plate riveted thereto with one-half-inch rivets, placed four inches between centers. If such doors are made double they shall have cross bars, levers and hooks so arranged that when the doors are closed they will be of strength equal to that of a single door. All doors shall be hung on frames made of three-quarter by 4-inch iron stiffened with an angle iron extending all around the same and fitting up snug to the wall. The frames shall be fastened to each other by bolts extending through the wall, such bolts being not more than two feet apart, and such doors shall swing on three hinges and shall be made to fit closely to the frame all around. The sills between the doors shall be of brick, iron, stone or concrete and shall rise at least two inches above the floor on each side of each opening. The lintel over the door shall be made of brick or iron, and the wall between the two door frames shall be covered with a coat of plaster at least one-half inch thick.

Sec. 111. **(Elevator Buildings.—Bins Of.)**—Elevator buildings (which term shall be interpreted as including all buildings intended solely for the receipt, storage and delivery of grain in bulk) may be constructed with the bin walls, both externally and internally, made entirely of wood; provided such walls are made solid and without cellular open spaces within them. The external bin walls shall have a covering of brick or hollow tile not less than twelve inches thick, which shall be united to the bin walls by anchors, in the construction and arrangement of which due allowance is made for the variations of shrinkage of the inclosing wall and of the wooden bin wall. If the weight of the bins is independently carried on a skeleton construction of timber, steel or iron, the first-story walls shall be of brick not less than twenty inches thick. If the outer walls of the outside bins and their facing are not carried on a skeleton construction, then the first-story wall shall not be less than twenty-eight inches thick, or as much thicker as may be required to keep the load upon the brickwork within the limits of stress elsewhere specified in this chapter. Elevator buildings may be built of reinforced concrete and they shall be built according to the provisions of Section 960 of this chapter.

Sec. 112. **(Cupola.—Inclosure Walls Of.—Openings.)**—The inclosing walls of cupolas on elevator buildings, if constructed of wood, shall be covered with corrugated iron or other incombustible material.

The outside openings in elevator buildings shall have protection of wire netting made of No. 14 wire, with meshes not over one-half by one-half inch.

All openings in the body of the first story of elevator buildings and the openings in the engine and boiler houses of the same and between these and the main building shall have iron doors made in accordance with the provisions of Section 110 of this chapter.

Section 113. **(Ventilating Ducts.—Chutes.—Walls Surrounding.)**—Wall surrounding ventilating ducts and rubbish and ash chutes shall be constructed in accordance with the regulations governing the construction of smoke flues elsewhere herein contained. Walls around ventilating ducts shall not be less than four inches thick, and when the ventilating duct is larger than 260 square inches the walls shall be not less than eight inches thick.

Sec. 114. **(Store Fronts.—Columns and Lintels Supporting.)**—The columns and lintels supporting store fronts in buildings within the fire limits of more than one story in height shall be made of incombustible material.

Sec. 115. **(Stairs in Buildings of Class I.—Number and Width Of.)**—There shall be in all buildings of Class I. of ordinary construction and of less floor area than one thousand square feet and not more than two stories in height, a stairway not less than three feet in width, and in all buildings of ordinary construction of more than one thousand square feet of floor area and less than three thousand square feet of floor area, two flights of stairs not less than three feet wide each. For buildings of ordinary construction of Class I. and of greater floor area than three thousand square feet, there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area, or fractional part thereof, up to nine thousand square feet of floor area.

For buildings of slow-burning or mill construction with a floor area of less than twelve hundred square feet and not more than two stories in height, there shall be a stairway not less than three feet in width; buildings of a greater floor area than twelve

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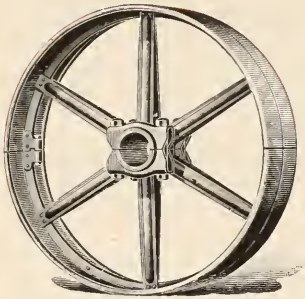

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hundred square feet and less than four thousand square feet shall have two flights of stairs, not less than three feet wide each, and there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area, or fractional part thereof, up to twelve thousand square feet. Provided, however, that additional flights of stairs may be used to make the aggregate width required, instead of widening the two flights above mentioned. It is further provided, however, that such stairs may be reduced one foot in width for each four stories in height, or fractional part thereof, above the fourth story of such building, but such stairs shall in no case be of less width than three feet.

For fireproof buildings there shall be required one flight of stairs not less than four feet wide for the first 3,000 square feet of floor area, or fractional part thereof. For buildings of more than 3,000 square feet and not exceeding 5,000 square feet of floor area, there shall be required one flight of stairs not less than five feet in width. For more than 5,000 square feet and less than 10,000 square feet of floor area there shall be an additional flight of stairs not less than three feet in width. For more than 10,000 square feet and less than 15,000 square feet of floor area, each of such stairs shall be of not less width than five feet. For more than 15,000 square feet and less than 25,000 square feet of floor area, there shall be not less than three stairways of an aggregate width of fifteen feet; none of such stairs shall be of less width than three feet.

The width of the different stairways need not be alike. The width of each stairway in the fifth, sixth, seventh and eighth stories may be six (6) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the ninth, tenth, eleventh and twelfth stories may be twelve (12) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive.

The width of each stairway in the thirteenth, fourteenth, fifteenth and sixteenth stories may be eighteen (18) inches less in the clear than the width of the stairways in the first to the fourth stories, inclusive, and this reduction in width may be continued in the same ratio in each additional four (4) stories added to the height of the building; provided, however, that no stairway shall have a less clear width than three (3) feet.

All stairways in buildings of Class I. shall have a hand rail on each side thereof, and where there is more than one stairway in any building of Class I. such stairways shall be located at each end of the building, or as far apart from each other as is practicable.

Doors and Windows.—When required to be closed, fire-resisting glass. See Section 1049.

Limitations in Changing Class of Buildings.—See Section 1050.

Buildings Used for the Purposes of More Than One Class.—See Section 62.

Courts, light shafts, well holes, etc., to be built in accordance with Section 707.

Sec. 116. **(Loads.—Allowance for Live Loads in Construction of Floors of Class I.)**—The floors of all buildings of Class I shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of floor construction of partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor; and the strength of such building shall be increased above the capacity to carry such a live load of (1) hundred pounds per square foot of floor surface when the uses to which such building or part thereof is to be applied involve greater stress.

Sec. 117. **(Floors.—Display of Placard Indicating Strength Of.)**—It shall be the duty of the owner of every building of Class I. already constructed, or hereafter to be constructed, or of his agent, or of the occupant or person in possession, charge or control of the same, to affix and display conspicuously on each floor of such building a placard stating the load per square foot of floor surface which may with safety be applied to that particular floor, or if the strength of different parts of any floor varies, then there shall be such placards for each varying part of such floor. It shall be unlawful to load any such floors, or any part thereof, to a greater extent than the load indicated upon such placards. It shall be the duty of occupants of buildings to maintain such placards during their occupation of the premises, and the owners of buildings, or their agents, to cause the same to be properly affixed with each change of occupation. It shall be part of the duty of architects of all buildings to calculate the figures for such placards, which are to be verified and approved by the Commissioner of Buildings before they are affixed upon the respective floors of the different buildings.

Walls.—Ledges.—See Section 997.

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Walls.—Around Stairs, Elevators and Shafts. See Section 998.
Walls.—Reinforced concrete. See Section 960.
Towers.—Domes.—Spires.—See Section 1026.

ARTICLE V.

PROVISIONS RELATING SOLELY TO CLASS II.

Sec. 200. (Class II.)—In Class II. shall be included ever office building, every hospital and every building used for hotel purposes, or for boarding or lodging house purposes, where such building so used for hotel, hospital or boarding or lodging house purposes is occupied by twenty or more persons.

Sec. 201. (Walls of Class II.)—The thickness of the walls of buildings of Class II. shall conform to the following requirements:

The thickness of the enclosing walls of buildings of this class shall be made in accordance with the following table, to-wit:

		STORIES										
	Basement.	1	2	3	4	5	6	7	8	9	10	11	12
Basement and	12	8											
Two-story	12	12	8										
Three-story	16	12	12	12									
Four-story	20	16	16	12	12								
Five-story	20	16	16	16	12	12							
Six-story	20	20	16	16	16	12	12						
Seven-story	24	24	20	20	16	16	12	12					
Eight-story	24	24	24	20	20	16	16	12	12				
Nine-story	28	24	24	20	20	20	16	16	12	12			
Ten-story	28	24	24	24	20	20	20	16	16	12	12		
Eleven-story	28	28	24	24	24	20	20	20	16	16	12	12	
Twelve-story	32	28	28	24	24	24	20	20	20	16	16	12	12

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 911 of this chapter.

Sec. 202. (Buildings.—Construction Of.—Height Of.)—Buildings of Class II. which are one hundred feet or more in height shall be built entirely of fireproof construction.

Buildings of Class II. less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning, or mill or fireproof construction. Buildings of Class II. not exceeding four stories in height and less than sixty feet in height may be built of ordinary construction.

Sec. 203. (Walls.—Division and Partitions in Boarding or Lodging Houses and Hotels.)—In buildings used wholly or in part for boarding houses, lodging houses or hotels, sixty feet or less in height, there shall be for every eight rooms in any one story dividing walls or partitions of incombustible material, separating such eight rooms from the contiguous spaces. Partitions surrounding stairs and corridors shall be made of fireproof material.

Sec. 204. (Stairs in Buildings of Class II.)—Stairs in Buildings of Class II. shall be adapted, in number and width, to the area, height and to the uses to be made of the building in which they occur.

For office buildings, by which shall be understood buildings divided into apartments intended for business uses only, and in which there shall be no sleeping apartments whatever, there shall be in buildings of ordinary construction and of less ground area than three thousand square feet, two flights of stairs not less than three feet wide each; and for office buildings of ordinary construction and of greater floor area than three thousand square feet, there shall be six inches added to the width of each such flight of stairs for each additional one thousand feet of floor area, or fractional part thereof, up to six thousand square feet of floor area; for office buildings of ordinary construction and of greater floor area than six thousand square feet, there shall be an additional flight of stairs not less than three feet wide for each additional three thousand square feet of floor area, or fractional part thereof.

For office buildings of slow-burning or mill construction there shall be at least two flights of stairs three feet wide each for the first four thousand square feet of floor area, and there shall be six inches added to the width of each such flight of stairs for each additional one thousand square feet of floor area, or fractional part thereof, up to eight thousand square feet of floor area; and an additional flight of stairs not less than three feet wide shall be required for each additional four thou-

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sand square feet of floor area, or fractional part thereof, above eight thousand square feet.

For fireproof office buildings there shall be required one flight of stairs not less than four feet in width for the first three thousand square feet of floor area, or fractional part thereof.

For fireproof office buildings of more than three thousand, and not exceeding five thousand square feet of floor area, there shall be required one flight of stairs not less than five feet in width.

For more than five thousand and less than ten thousand square feet of floor area there shall be required an additional flight of stairs not less than three (3) feet in width.

For more than ten thousand and less than twenty thousand square feet of floor area there shall be required two flights of stairs of not less width than five (5) feet each; provided, that for each and every fireproof building of more than ten thousand square feet floor area there shall be at least two stairway fire escapes, placed as far apart as practicable, on such buildings, in addition to the standpipe and platform fire escape required by this chapter and the statutes of this state.

An additional flight of stairs shall be required for each additional ten thousand square feet of floor area; provided, that for each additional five thousand square feet of floor area such stairway shall be not less than three feet wide.

And for additional floor areas between five thousand and ten thousand square feet such stairway shall not be less than five feet in width. The width of the different stairways need not be the same.

*(**Hospitals, Hotels, Boarding or Lodging Houses.—Stairways.**)—For all buildings of Class II. of ordinary construction used as hotels, boarding or lodging houses, or hospitals, there shall be required for each building at least two flights of stairs, which, for buildings of three thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of six inches in width for each additional one thousand square feet of floor area, or fractional part thereof, up to a floor area of six thousand square feet; and after that there shall be an additional flight of stairs not less than three feet wide for each additional three thousand feet of floor area, or fractional part thereof.

For all buildings of Class II. slow-burning or mill construction used as hospitals, hotels, boarding or lodging houses, there shall be required for each building at least two flights of stairs, which, for buildings of four thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of six inches in width for each additional one thousand square feet of floor area, or fractional part thereof, up to a floor area of six thousand square feet; and after that there shall be an additional flight of stairs not less than three feet wide for each additional three thousand feet of floor area, or fractional part thereof.

For all buildings of Class II. of fireproof construction used as hospitals, hotels, boarding or lodging houses, there shall be required for each building at least two flights of stairs, which, for buildings of five thousand square feet or less in floor area, shall be of not less width than three feet each, with an increase of five inches in width for each additional one thousand square feet of floor area up to a floor area of ten thousand square feet, and there shall be required an additional flight of stairs not less than three feet wide for each additional four thousand square feet of floor area, or fractional part thereof.

Each stairway in the fifth, sixth, seventh and eighth stories may be built six (6) inches less in width in the clear than the stairways in the first to the fourth stories, inclusive.

Each stairway in the ninth, tenth, eleventh and twelfth stories may be built twelve (12) inches less in width in the clear than the stairways in the first to the fourth stories, inclusive.

Each stairway in the thirteenth, fourteenth, fifteenth and sixteenth stories may be built eighteen (18) inches less in width in the clear than the stairways in the first to the fourth stories inclusive, and this reduction in width may be continued in the same ratio in each additional four (4) stories added to the height of the building; provided, however, that no stairways shall have a less clear width than three (3) feet.

All stairways in buildings of Class II. shall have a hand rail on each side thereof, and where there is more than one flight of stairs in any building of Class II., such stairways shall be located at each end of the building, or as far apart from each other as is practicable.

*Sec. 205. (**Fire Stops.**)—In hotels, hospitals, lodging houses or boarding houses, of other than fireproof construction, there shall be a fire stop of brick, concrete or tile, between the ceiling and floor in each floor of joists for each twenty-five feet, or fractional part thereof, measured in the direction of the length of the joists.

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Sec. 206. **(Air.—Means of Communication with Outer Air in Buildings of Class II.)**—In all buildings of this class the courts, windows, light shafts, alcoves and vents shall be of the same size and dimensions as are prescribed in Sections 615, 623, 625, 627, 635, 636, 638 to 645, 646, 648 of this chapter relating to buildings of Class VI.

Sec. 207. **(Joists.—Supports For.)**—If in buildings of Class II. the distance between the enclosing walls is more than twenty-four feet in the clear, there shall be intermediate supports for the joists, which supports shall be either brick walls or iron or steel columns and beams or trusses or girders. If brick walls are used for this purpose, they may, in all cases where the thickness of walls is given in the table as sixteen inches or more, be made four inches less in thickness than the dimensions stated in the table.

Sec. 208. **(Loads.—Allowance for Live Loads in Construction of Floors of Class II.)**—For all buildings of Class II. the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, partitions and permanent fixtures and mechanism that may be set upon the same, a live load of fifty pounds for every square foot of surface in such floors.

Sec. 209. **(Stalls or Rooms of Class II.—When Considered Habitable.)**—In buildings of Class II. no room shall be considered habitable or used as a habitation unless it has at least one window of an area equal to one-tenth of the superficial area of such room, opening into the external air. Provided, however, that no stall or compartment used as a sleeping room in a building, the walls of which stall or compartment do not extend within a distance of two and one-half feet from the ceiling thereof, shall be regarded and considered to be a room within the intent and meaning of the provisions hereof, but the walls of every such stall or compartment shall be of incombustible material.

Sec. 210. **(Hospitals.—Construction.—Height Of.—Permits.—Special Consents.)**—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage in any block, if two-thirds of the buildings fronting upon both sides of the streets bounding such block or square are devoted chiefly to residence purposes, any hospital for the care, treatment or nursing of three or more insane persons; or any hospital for the care, treatment or nursing of three or more inebriates, or persons suffering from the effect of the excessive use of alcoholic liquors; or any hospital for the care, treatment or nursing of three or more epileptics; or any hospital for the care, treatment or nursing of three or more persons addicted to, or suffering from, the excessive use of morphine, cocaine or other similar drugs or narcotics; or any hospital for the care, treatment or nursing of any person affected with any infectious or contagious disease, unless the owners of a majority of the frontage in such block or square, and in addition thereto the owners of a majority of the frontage on the opposite sides of the streets bounding such block or square, consent in writing to the building, constructing, maintaining, managing or conducting of any such hospital in such block or square. Such written consents of the majorities of such property owners shall be filed with the Commissioner of Buildings, and an exact copy of the same shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing, or a license issued for the maintaining, conducting or managing of any such hospital. Provided, that any building that may be used for hospital purposes which is over two stories in height shall be of fireproof construction throughout, and no hospital shall be built to exceed six stories in height.

Sec. 211. **(Hospitals.—Location of Near School Houses.)**—No hospital of any kind or description hereafter erected or established within four hundred feet of property used for school purposes.

(Walls.—Ledges.—Joist Supports.)—All ledges in walls shall be as specified in Section 997 of this ordinance.

Walls.—Reinforced concrete. See Section 960.

***(Roofs.—Strength Of.)**—The roofs of buildings of Class II. shall be designed and constructed as is required in Sections 1013 and 1023.

Roofs.—Shingle.—See Section 1021.

Towers, Domes and Spires.—Construction of.—See Section 1026.

Skylights.—Construction, Glass in. See Section 1027.

Bay Windows and Light Shafts.—Material for. See Section 1010.

Doors and Windows.—When required to be closed.—Fire-resisting glass. See Section 1049.

Wind Pressure.—Precautions against. See Section 1013.

Windows.—Cleaning, safety devices. See Section 1147.

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Buildings Used for the Purposes of More than One Class.—See Section 62.
Limitations in Changing Class of Buildings.—See Section 1050.
Walls.—Around Stairs, Elevators and Shafts.—See Section 998.

ARTICLE VI.

PROVISIONS RELATING SOLELY TO CLASS III.

Sec. 300. **(Class III.)**—In Class III. shall be included every building used as a family residence; also every building used for stabling purposes, where such building so used shall occupy a ground area of less than five hundred square feet.

Sec. 301. **(Walls of Class III.—Thickness of.)**—Buildings of Class III. shall conform to the following requirements:

The thickness of enclosing walls of buildings of this class shall be in accordance with the following table, to wit:

		STORIES										
	Basement.	1	2	3	4	5	6	7	8	9	10	11	12
Basement and	12	8											
Two-story	12	12	8										
Three-story	16	12	12	12									
Four-story	20	16	16	12	12								
Five-story	20	16	16	16	12	12							
Six-story	20	20	16	16	16	12	12						
Seven-story	24	24	20	20	16	16	12	12					
Eight-story	24	24	24	20	20	16	16	12	12				
Nine-story	28	24	24	20	20	20	16	16	12	12			
Ten-story	28	24	24	24	20	20	20	16	16	12	12		
Eleven-story	28	28	24	24	24	20	20	20	16	16	12	12	
Twelve-story	32	28	28	24	24	24	20	20	20	16	16	12	12

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 911 of this chapter.

Sec. 302. **(Buildings.—Construction Of.—Height Of.)**—Buildings of Class III. which are one hundred feet or more in height shall be made entirely of fireproof construction.

Buildings of Class III. less than one hundred feet and more than sixty feet in height shall be built entirely of slow-burning mill or fireproof construction.

Buildings of Class III. less than sixty feet in height may be built of ordinary construction.

Sec. 303. **(Skylights.—Construction Of.—Glass In.)**—The skylight on the roof of any building of Class III., other than a frame building, shall have the sides, sashes and frames constructed of metal, or of wood metal clad on all exterior surfaces. If the building exceed three stories in height, such skylight shall have at least six inches over same a strong wire netting (wire not lighter than No. 8 and mesh not coarser than 1½x1½ inches), unless the glass contains a wire netting within itself.

Sec. 304. **(Loads.—Allowance for Live Loads in Construction of Floors of Class III.)**—For all buildings of Class III. the floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of forty pounds for every square foot of surface in such floors.

Sec. 305. **(Rooms of Class III.—When Considered Habitable.)**—In buildings of Class III., no room shall be considered habitable or used as a habitation unless it has at least one window of an area equal to one-tenth of the superficial area of such room opening into the external air.

Sec. 306. **(Fire Walls.—Thickness Of.—When Dispensed With.)**—In buildings of Class III., fire walls of brick not less than twelve inches thick shall be built, extending above the roofs of all buildings, if such roofs are flat, and also above the roofs of all buildings where the same abut against another building, or where the same stands upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or where the building is not over three stories high, the fire walls may be eight inches thick. Such fire walls, where they stand upon lot lines or where they are over the dividing walls between buildings, or over the dividing walls in the interiors of buildings, where such are required by the provisions of this chapter by reason of the great area of such buildings, shall extend at least two feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines, if

the tops of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of mortar or hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispenssd with in all cases where the entire framing and material of the roof is made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 307. **(Bay Windows and Light Shafts.—Material For.)**—Bay or oriel windows and light shafts may be built of combustible material in buildings of Class III. of two stories or less in height, provided, such bay and oriel windows or light shafts shall not have a greater width than twelve feet at wall line of building, and, provided, that the outside walls, roofs and soffits of such bay or oriel windows and light shafts, when so constructed, shall be covered with sheet metal or other incombustible material. In all other cases, bay and oriel windows and light shafts and their supports shall be constructed entirely of incombustible material.

Sec. 308. **(Walls.—Brick Wall Upon Wooden Sills.—Level of Sills Allowed.)**—All buildings of Class III. not exceeding one story in height and twenty feet in height from top of sills to highest point of roof, and with side walls not exceeding fourteen feet in height, and with floor area not exceeding one thousand two hundred square feet, may have brick walls not less than eight inches in thickness erected on wooden sills, the sills supported on iron, masonry or concrete supports extending four feet below the surface of the ground. The foundations under such supports shall be of concrete, stone or brick, each covering not less than five square feet area and not more than eight feet apart to support the weight that may rest upon them with safety; sills shall be placed not higher than four feet above the established grade on the street fronting the lot upon which the building is erected, where grades are established, and not exceeding seven feet above the ground where grades are not established. In all cases of buildings being more than one story and less than two stories high, and having a gable or hip roof of not less than one-third (1-3) pitch, 8-inch walls on solid brick or stone masonry may be used, provided they do not exceed 14 feet in height measured from first floor joist, and provided such buildings have a floor area not exceeding one thousand two hundred (1,200) feet, and are not over twenty-two feet in width.

Roofs.—Strength Of. See Sections 1013 and 1023.
Roofs.—Shingle and Gravel. See Section 1021.
Wind Pressure. Precautions against. See Section 1013.
Walls.—Reinforced Concrete. See Section 960.
Walls.—Ledges. See Section 997.
Towers, Domes and Spires. See Section 1026.
Limitations in Changing Class of Buildings. See Section 1050.

ARTICLE VII.

PROVISIONS RELATING SOLELY TO CLASS IV.

Sec. 400. **(Class IV.)**—In Class IV. shall be included every building used as an assembly hall, whether such hall is used for the purpose of worship, instruction or entertainment, unless such building is used for any of the purposes for which buildings of Class V. or Class VIII. are used.

Sec. 401. **(Walls.—Outside Walls of Class IV.—Structures Built Above.—Walls Of.)**—The outside walls of all buildings used wholly or in part for the purposes of Class IV., the roof or ceiling of which is carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high, not less than twenty inches thick.

If they are more than twenty-five feet high and less than forty-five feet high, they shall not be less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high, they shall not be less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high, they shall not be less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall not be less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long without cross walls of equal height.

Walls around stairs, elevators and shafts. See section 998.

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For rooms used for the purposes of Class IV., where such rooms are less than fifty feet wide in the clear, the thickness of the walls enclosing or surrounding such rooms may be reduced by four inches.

The outside walls of all buildings of Class IV., the roof or ceiling of which is not carried on trusses or girders, shall be of the same thickness as in buildings of Class I.

If on or more stories are built above the room or rooms, or portion of any such building devoted to the uses of Class IV., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above every such room.

If solid masonry buttresses are employed, and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel pillars are inserted in such walls for the support of the superstructure, and at distances not more than twenty-four feet between centers, and if such pillars extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or pillars; but in no case shall any such wall be less than twelve inches thick in the top story; four inches shall be added, going downwarad, for each story, or for each twenty-five feet in height of wall. Provided, that if in any building of this class now in existence the structural parts thereof do not comply with the foregoing requirements, and structural changes are made therein, then all walls, columns or other structural parts shall be strengthened in a manner satisfactory to the Commissioner of Buildings.

Sec. 402. **(Walls.—Columns In.)**—If iron or steel columns are introduced in such walls, the brickwork around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed, as provided in Section 912 of this chapter.

Sec. 403. **(Frontage of Class IV. Seating Less Than 800.)**—Buildings of Class IV., containing halls of an aggregate seating capacity of eight hundred persons or less, shall have for each hall a frontage upon two public spaces, of which at least one shall be a street, and of which the other, if it is not a street, shall be a public or private alley, not less than ten feet wide, opening directly on a public street.

Sec. 404. **(Frontage of Class IV.—Seating Over 800.)**—Buildings of Class IV., containing halls or rooms used for the purposes of Class IV. of greater aggregate seating capacity than eight hundred, shall have for each hall a frontage upon three open spaces, of which at least one shall be a public street, while the two others, if not streets, shall be public or private alleys of a width of not less than ten feet each, opening directly on a public street, or fireproof passageways or tunnels of not less than seven feet each in width may be used in place of these alleys, provided, such passageways or tunnels lead to a public thoroughfare.

Sec. 405. **(Buildings.—Class IV.—Construction Of.)**—Buildings of Class IV., containing halls or rooms, used for the purposes of Class IV., of an aggregate seating capacity of not more than eight hundred, may be built of ordinary construction. If such halls or rooms have a greater aggregate seating capacity than eight hundred and less than one thousand five hundred, such buildings shall be built of mill, slow-burning or fireproof construction. If such halls have an aggregate seating capacity of one thousand five hundred or more, such buildings shall be built entirely of fireproof construction.

In computing the seating capacity of any room or building used for the purposes of Class IV., in which the seats are not fixed, an allowance of eight square feet of floor area shall be made for each person, and all space between the walls or partitions of such room or building shall be measured in this computation.

Sec. 406. **(Buildings of Class IV., Used Partly for Other Purposes.)**—Any building occupied wholly or in part for the purposes of Class IV., shall be built entirely of fireproof construction, if the halls or rooms used for the purposes of Class IV. therein have an aggregate seating capacity greater than one thousand five hundred.

Sec. 407. **(Buildings of Certain Height.—Construction Of.)**—Any building higher than sixty feet and connected with or made part of any building used wholly or in part for the purposes of Class IV., shall be entirely of fireproof construction. Any such building less than sixty feet in height shall, if its case is not already covered by other provisions of this chapter, be made of fireproof, slow-burning or mill construction.

Sec. 408. **(Openings Between Non-Fireproof Buildings.)**—In all cases where fireproof construction is not used for the whole of two or more connected buildings, used wholly or in part for the purposes of Class IV., there shall be at each connecting opening double iron doors.

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Sec. 409. **(Spires, Cupolas and Domes Upon Houses of Worship.)**—Spires, cupolas or domes with a framework of non-fireproof material and covered on the outside with incombustible material, may be erected as part of any house of public worship, and if such house of worship is so built that it is nowhere nearer than twenty feet to any line of the lot upon which it stands (street and alley lines excepted), such non-fireproof spires, cupolas or domes may be maintained only while this intervening space of twenty feet is maintained unoccupied as part of the grounds or premises belonging to such house of public worship.

Sec. 410. **(Violation.—Spires, etc., to Be Taken Down.—Roofs of Isolated Buildings of Class IV.)**—If the conditions of such building be so changed that there shall not be a vacant space as hereinbefore required surrounding same, such spire, cupola or dome shall be forthwith taken down.

The roofs of isolated buildings, occupied for purposes of Class IV., shall be constructed in the same manner as that provided for spires, domes and cupolas.

Provided, however, that the roofs of houses of worship outside the fire limits not exceeding tweny-eight hundred square feet in area may be covered with shingles.

Sec. 411. **(Floor Levels.—Limitation of Floor Levels of Class IV.—Auditorium Floor of Class IV.—Height Above Sidewalk.—Stairs.)**—The following limitations of floor levels in buildings occupied either wholly or in part for purposes of Class IV. shall be observed in all cases.

In buildings occupied either wholly or in part for purposes of Class IV., no auditorium of a greater seating capacity than one thousand shall have the highest part of its main floor at a greater distance than ten feet above the adjacent sidewalk grades. No room or rooms used for the purposes of Class IV., of greater seating capacity than five hundred, shall be at a greater distance from the sidewalk grade than thirty feet. No room or rooms used for the purpose of Class IV., of greater seating capacity than two hundred, shall be at a higher level above the sidewalk grade than forty-five feet.

Provided, however, that in the case of a building used either wholly or in part for the purposes of Class IV., and built wholly of fireproof construction, a room or rooms to be used for the purposes of Class IV., and of an aggregate seating capacity of less than five hundred, may be located in any story thereof, but in such case there shall be at least two separate and distinct flights of stairs from the floor or floors in which such room or rooms are located to the ground, each of which stairs shall be not less than four feet wide in the clear.

Sec. 412. **(Loads, Allowance for Live Loads in Construction of Floors of Class IV.)**—All floors of all buildings of Class IV. shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floor.

Sec. 413. **(Stairways.—Entrances and Exits, Width of.)**—The width of stairways in buildings used wholly or in part for the purposes of Class IV. shall be eighteen inches for every one hundred of the aggregate seating capacity of all rooms in such building, which are used for the purposes of Class IV., and for fractional parts of each one hundred seating capacity a proportionate part of eighteen inches shall be added to the width of such stairways, but no stairway in such building shall be less than four feet wide in the clear, except as hereinafter provided; and provided, further, that in any such building having a room or rooms used for purposes of Class IV., the aggregate seating capacity of which shall not exceed two hundred and fifty, two separate and distinct three-foot stairways shall be permitted.

All stairways shall have hand railings on each side thereof. Stairways which are over 7 feet wide shall have double intermediate handrails, with end newel posts at least 5½ feet high. No stairways shall ascend a greater height than thirteen feet six inches without a level landing, which, if its width is in the direction of the run of the stairs, shall not be less than three feet wide, or which, if at a turn of the stairs, shall not be of less width than the width of the stairs.

Stairways leading to a box or boxes, seating not to exceed thirty people in the aggregate, shall be independent of all other stairs or seats and not less than two feet six inches wide in the clear. For each additional twenty-five of seating capacity, or major portion thereof, in such boxes, an additional width of five inches shall be added to such stairways.

(Walls.—Ledges.)—See Section 997.

(Doors and Windows.—When Required to Be Closed.—Fire-Resisting Glass.)—See Section 1049.

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Sec. 414. **(Balconies and Galleries.—Exit and Entrance.)**—Distinct and separate places of exit and entrance shall be provided for each gallery. A common place of exit and entrance may serve for the main floor of the auditorium and the balcony, provided its capacity be equal to the aggregate capacity of all aisles or corridors leading from the main floor and such balcony to such place of exit and entrance.

Sec. 415. **(Balconies and Galleries.—Designation of.)**—Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be plainly printed on all admission tickets.

Sec. 416. **(Aisles.—Steps in Aisles.—Passageways.—Kept Unobstructed.—Width of Corridors, Passages, Hallways and Doors.)**—Aisles in rooms or auditoriums used for the purposes of Class IV. shall in the aggregate be eighteen inches in width for each one hundred of the seating capacity of such room or auditorium, and for fractional parts of one hundred, a proportionate part of eighteen inches shall be added; but no aisle shall be less than two feet and six inches in width in its narrowest part.

Steps shall be permitted in aisles only as extending from bank to bank of seats, and whenever the rise from bank to bank of seats is less than five inches the floor of the aisles shall be made as an inclined plane, and where steps occur in outside aisles or corridors, they shall not be isolated, but shall be grouped together and there shall be a light so placed as to illuminate such steps in such outside aisles or corridors. All aisles and passageway in such rooms or auditoriums shall be kept free from camp stools, sofas, chairs and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert, ball, or any public assembly.

Sec. 417. **(Corridors, Passageways, Hallways and Doors.—Width of.)**—The Width of corridors, passageways, hallways and doors adjacent to, connected with or a part of such rooms or auditoriums, shall be computed in the same manner as is herein provided for stairways and aisles, excepting, however, that no such corridor, passageway or hallway shall be anywhere less than four feet in width, and no such door shall be less than three feet in width.

Sec. 418. **(Seats.—Number of in Rows.)**—There shall not be more than fourteen seats in any one row between aisles.

Rows of seats shall not be less than 2 feet 8 inches from back to back, and no bank of seats shall be of greater rise than 24 inches.

Sec. 419. **(Emergency Exits.)**—Emergency exits and stairways shall be provided outside of the walls of all assembly halls of a larger seating capacity than eight hundred. Provided, however, that if any such assembly hall is used for any of the purposes described in Section 425 of this chapter, and has a seating capacity of more than four hundred, such assembly hall shall have emergency exits to the street of one-half the aggregate width of the main exits, but no such emergency exit shall be less than three feet in width.

Such emergency exits and stairways therefrom may be built inside the walls of the building in a corridor or passageway not less than seven feet wide, which corridor or passageway shall be surrounded by a fireproof partition, not less than four inches thick.

Such stairways shall be made of wrought iron or steel, or other approved fireproof material, and cast iron is not approved for this work. All emergency exits and stairways therefrom shall be kept free from obstruction of any kind, including snow and ice.

Sec. 420. **(Doors to Open Outward.)**—All doors affording access directly or indirectly to the street from any room used for the purposes of Class IV. shall open outward upon suitable hinges.

Exit doors from such rooms shall not be obscured by draperies and shall not be locked, or fastened, in any manner during the entire time any such room is open to the public, but shall be so constructed and maintained that they may be easily opened from the interior.

Sec. 421. **(Walls Between Auditorium and Stage.)**—In buildings used either wholly or in part for the purposes of Class IV. hereafter erected, there shall be a solid brick wall, of the same thickness as that called for on the outside walls, between the auditorium and stage; and in non-fireproof buildings such walls shall extend to a height of three feet above the roof. Provided, however, that in existing buildings, any room used for the purposes of Class IV., and having a seating capacity greater than four hundred, shall have the proscenium wall built of incombustible material.

Sec. 422. **(Curtain Shall Be Iron, Steel or Asbestos.—Inspection Of.—Fee.)**—The main curtain opening in any such room shall have a wrought iron or steel or asbestos curtain, which shall be inspected by the building department semi-annually, for which

inspection a charge of two dollars shall be made, and all other openings in the proscenium wall shall have self-closing iron doors.

Sec. 423. (Structures Over Ceiling.—Construction.)—If any structure is built over the ceiling or roof of any building used either wholly or in part for the purposes of Class IV., the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner required for columns or for fireproof buildings of Class I.

Sec. 424. (Fire Apparatus on Stage.)—In all rooms used for the purpose of Class IV. of a seating capacity of two hundred and fifty or more, where stationary scenery is used, there shall be kept for use two or more portable fire extinguishers or hand fire pumps on and under the stage, and also four fire department axes, two fifteen-foot hooks and two ten-foot hooks on each tier or floor of the stage, subject to the approval of the Fire Marshal, and in such rooms of less seating capacity than two hundred and fifty, there shall be at least one portable fire extinguisher.

Sec. 425. (Rooms Used for Regular Theatrical or Vaudeville Performances.—Exit Doors.)—Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time any such room of Class IV. is open to the public, so as to prevent them from being easily opened outwardly; and such doors shall be so constructed and maintained, as to require no special knowledge or effort to open them from the interior.

It shall be the duty of every person, or corporation, operating or maintaining any room, having a seating capacity of three hundred or more, used for the purposes of Class IV., and which is used regularly for theatrical or vaudeville performances and where an admission fee is charged, to employ one competent, experienced fireman, who shall be detailed by the Fire Marshal, and who shall be in the uniform of the Chicago Fire Department. Such fireman shall be on duty during the whole time such room is open to the public, and he shall report to and be subject to the orders of the Fire Marshal; he shall see that all fire apparatus required by this chapter is in its proper place and in proper condition ready for use, and that all exits are unlocked during the whole time such building is open to the public.

Such fireman and the Fire Marshal shall require all persons employed in or about such room to be drilled in the use of all apparatus and appliances for the prevention of fire installed therein, at least twice in every week, and such fireman shall report to the Fire Marshal the manner and efficiency of such drill. Such fireman shall report in writing daily to the Fire Marshal the condition and equipment of the building, or portion thereof, to which he is detailed. No fireman shall be on duty at any one building for a longer period than two weeks.

Sec. 426. (Standpipe and Hose on Stage.)—A standpipe not less than one and one-half inches in diameter, with a hose connection and hose valve therein, shall be installed on each side of the stage in such room, and shall at all times have a hose connected thereto, ready for use.

Such standpipe shall be connected with a power pump or gravity tank so that a sufficient pressure of water shall be furnished through such standpipe to afford adequate fire protection. The pressure to be furnished by such tank or pump shall be satisfactory to the Fire Marshal.

Sec. 427. (Vents or Flue Pipes.)—One or more vents or flue pipes of metal construction or other incombustible material approved by the commissioner of buildings shall be built over the stage, and shall extend not less than ten feet above the highest point of the roof, and shall be equivalent in area to one-twentieth of the area of the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the building to a point five feet above the highest point of the additional stories.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery, approved by the City Electrician.

Such dampers shall be controlled by two switches, one at the Electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station on the opposite side of the stage; such switches shall be located in such places on the stage as may be designated by the Fire Marshal, and each switch shall have a sign with plain directions as to the operation of same printed thereon.

Sec. 428. (Fuse Boxes.)—All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuse shall be exposed to the air between the switchboards; all electrical equipment in such rooms shall be installed and maintained to the satisfaction and approval of the City Electrician.

Sec. 429. **(License.)**—The amusement license for each room used for the purposes of Class IV. shall state the number of persons such room has accommodations for, which number shall be governed by the provisions of this chapter relating thereto, and no more than that number shall be allowed to be in such room at any one time.

No amusement license shall be issued for any room used for the purposes of Class IV. unless the Commissioner of Buildings, the Fire Marshal and the City Electrician shall first have certified, in writing, that such room complies with the provisions of this ordinance in every respect.

Sec. 430. **(Exits.—Diagram of Printed on Programs.)**—It shall be the duty of the owner, lessee, or manager of every room used for the purposes of Class IV., and in which programs are issued for performances given therein, to cause to be printed on such programs a diagram showing conspicuously the exits from such room.

Sec. 431. **(Exit.—Signs Over.)**—The word "Exit" shall be in letters at least six inches high over the opening to every means of egress from any such room, and in any such room having a greater seating capacity than four hundred, a red light furnished by gas or sperm oil shall be kept burning over such word during the entire period such room is open to the public and until the audience has left such room.

Sec. 432. **(All Parts of Room Well Lighted During Performance.)**—Every portion of any room used for the purposes of Class IV. and all outlets therefrom leading to the streets, including the passageways, courts and corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall be kept so lighted until the entire audience has left the premises; and every passageway, or court, or corridor, or stairway, or exit, or emergency exit stairway, shall be provided with signs, indicating the way out of the building, the letters of which shall not be less than six inches in height.

Sec. 433. **(Lights in Halls, Corridors and Lobbies, Control of.—Separate Shut-Off.—Connection with Gas Mains.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Foot Lights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Protection of Stage Lights.)**—All gas or electric lights in the halls, passageways, corridors, lobby or other means of ingress to or egress from any such room shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying any such room shall have independent connections for the auditorium and stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any part of any such room, shall be provided with proper wire netting underneath. No gas or electric light shall be inserted in the walls, woodwork, ceilings, or in any part of any such room, unless protected by fireproof materials. The footlights, if gas light, in addition to the wire network, shall be protected by a strong wire guard, not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of, and be surrounded by, fireproof materials. All border lights shall be constructed according to the best known methods, subject to the approval of the City Electrician, and shall be suspended by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal, and made double, with an air space between. All stage lights, if gas, shall have strong metal wire guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flame, and such guards or screens shall be firmly soldered to the fixtures in all cases.

The use of calcium lights in any hall or room used regularly for theatrical or vaudeville performances is prohibited, and no calcium lights shall be permitted upon any stage; all arc lights used on the stage shall be subject to the approval of the City Electrician.

Sec. 434. **(Apparatus Under Control of Fire Marshal.)**—The standpipes, hose, and all apparatus for the extinguishing of fire or guarding against the same, required by the provisions of this ordinance to be provided, shall be at all times so provided and kept in a manner satisfactory to the Fire Marshal.

Sec. 435. **(Scenery to Be Incombustible.)**—No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of class IV., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

Sec. 436. **(Commissioner of Buildings, City Electrician, Fire Marshal and Superintendent of Police Empowered to Enter.)**—The Commissioner of Buildings, City Electrician, Fire Marshal, Superintendent of Police, and their respective assistants,

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shall have the right to enter any building used wholly or in part for the purposes of Class IV. and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such building, and it shall be unlawful for any person to interfere with them in the performance of their duties.

Sec. 437. **(Power of Officers to Close.)**—The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police, or any one of them, shall have the power, and it shall be their joint and several duty, to order any building used wholly or in part for the purposes of Class IV. closed, where it is discovered that there is any violation of any of the provisions of this article, until the same are complied with.

Sec. 438. **(License.—Mayor Shall Revoke.)**—Upon the report to the Mayor by the Commissioner of Buildings, Fire Marshal, City Electrician, or Superintendent of Police, or any of them, that any order or requirement of this article in regard to buildings used wholly or in part for the purposes of Class IV. has been violated or is not being complied with, in any such building, the Mayor shall revoke the amusement license of any amusement or entertainment therein conducted, and shall cause such building, or portion thereof, devoted to the uses of Class IV., to be closed.

ARTICLE VIII.

PROVISIONS RELATING SOLELY TO CLASS V.

Buildings of Class V. Now in Existence.

Sec. 500. **(Class V.)**—In Class V. shall be included every building which is used as a public theater where an admission fee is charged and in which movable scenery is used; provided, however, that public halls and club halls, with a seating capacity of less than six hundred, although occasionally used for theatrical representations, shall not be construed to be public theaters within the meaning of the term as used in this section, notwithstanding the fact that movable scenery is used upon the stage thereof on such occasions, and such public halls and club halls shall not be considered as buildings of Class V. as herein defined. Such public halls and club halls shall be included in Class IV., as defined in Section 400 of this ordinance.

Sec. 501. The following provisions shall apply to buildings now in existence and used wholly or in part for the purposes of Class V.

Sec. 502. **(Walls.—Outside.—Structures Built Above.)**—The outside walls of all such buildings, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high, they shall be not less than twenty inches thick.

If they are more than twenty-five feet and less than forty-five feet high, they shall be not less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high, they shall be not less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high, they shall be not less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall be not less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long, without cross-walls of equal height.

The thickness of the walls enclosing or surrounding rooms used for the purposes of Class V., where such rooms are less than fifty feet wide, may be reduced by four inches.

If one or more stories are built above any room devoted to the uses of Class V., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above such room.

If solid masonry buttresses are employed and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel columns are inserted in such walls for the support of the superstructure, and at a distance not more than twenty-four feet between centers, and if such columns extend to and carry the superimposed trusses and girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or columns, but in no case shall any such wall be less than twelve inches thick in the top story, and four inches shall be added, going downward, for each story, for each gallery, or for each twenty-five feet in height of wall. Provided, that if in any such building now in existence the structural parts thereof do not comply with the

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foregoing requirements and structural changes are made therein, then all walls, columns or other structural parts shall be strengthened in a manner satisfactory to the Commissioner of Buildings.

Sec. 503. **(Columns in Walls.)**—If iron or steel columns are introduced in such walls, the brick work around the same shall be bonded into that of the connecting walls, and each of such columns shall be fireproofed as provided in Section 912 of this chapter.

Sec. 504. **(Alterations.)**—All alterations in such existing buildings intended to make them comply with the requirements of this chapter may be executed with the same kind of materials as those originally used in the construction of such buildings, unless otherwise provided by this chapter.

Sec. 505. **(Other Classes Built in Conjunction with Class V.—Doors for Openings Between Connecting Buildings.)**—In all cases where existing buildings used wholly or in part for the purposes of Class V. are built in conjunction with or as part of buildings devoted to the uses of other classes, and where such buildings of the other classes, as specified in this chapter, are not built entirely of fireproof construction, double iron doors shall be placed at each connecting opening between such buildings of Class V., and the building connected therewith.

Sec. 506. **(Floor Levels.—Limitations of.)**—The audience room or rooms or auditorium or auditoriums used for the purposes of Class V., containing in the aggregate not more than five hundred seats, if in a fireproof building, may be located in any story thereof, but in such case there shall be at least two separate stairways from the floor or floors in which such audience room or auditorium is located to the ground, each of which stairways shall be not less than four feet in width in the clear.

In existing buildings of fireproof construction, having an audience room or an auditorium with a seating capacity of more than five hundred feet and less than fifteen hundred, the lowest bank of seats of the main floor thereof shall be not more than twelve feet above the street level, and every such building shall in all other respects conform to the requirements of this chapter. The main floor of no existing theater of any construction other than fireproof shall be raised above its present elevation.

Sec. 507. **(Loads.—Allowance for Live Loads in Construction of Floors of Class V.)**—For all buildings of Class V., all floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

Sec. 508. **(Stairways.—Entrances and Exits.)**—Stairways affording ingress to or egress from any room or rooms used for the purposes of Class V. shall be in width equivalent to twenty inches for every one hundred of seating capacity of such room and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairway be less than four feet wide in the clear, except as hereinafter provided in this section.

All such stairways shall have hand railings on each side thereof and shall not ascend a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall not be less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over 7 feet wide shall have double intermediate handrails, with end newel posts at least 5½ feet high.

Steps shall not have a greater rise than seven and three-eighths inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase, except where circular staircases are expressly permitted.

In existing theaters each and every balcony and gallery shall have separate and distinct entrance stairways from the sidewalk level, except that in cases where the vestibule or entrance to any such theater is not more than fifteen inches, or two steps, above the sidewalk level and such steps are at or near the building line, the stairways to such balcony and gallery may ascend from the floor of such vestibule or entrance, but if the run of the stairs at the bottom is not toward the street, there shall be a hand rail or rails three feet above the floor constructed from the foot of such stairways for a distance of not less than five feet leading toward the street. All doors intervening between such stairways and the street shall, during each and every performance, be kept unfastened.

There shall be an iron stairway or stairways from the stage to the fly galleries and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

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Stairs leading to a box or boxes seating not to exceed thirty people, in the aggregate, shall be independent of all other stairs and seats and not less than two feet eight inches wide in the clear. For each additional twenty-five of seating capacity, or major portion thereof, there shall be an additional width of five inches added to such stairways.

All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

Instead of increasing the width required for entrances, aisles, exits and stairways to that required by this chapter, the owner, lessee or manager of any such theater shall have the privilege of reducing the number of permanent seats therein until the same ratio betwen such width and number of seats as hereinbefore provided for shall be established, and if such privilege be taken advantage of, it shall be the duty of the Commissioner of Buildings to make inspection and certify that such ratio actually exists before a license for the operation of any such theater shall be issued.

Sec. 509. **(Floors at Exits.)**—Floors at all exits shall be so designed as to be level and flush with adjacent floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

Sec. 510. **(Seats in Rows Between Aisles.)**—More than ten seats in any row between aisles in any gallery shall not be permitted. On the main floor and balcony, not more than eleven seats between aisles shall be permitted; provided, however, that in banks of seats on main floors and balconies that are not at a greater distance than twenty feet from an exit, thirteen seats shall be permitted between aisles.

Seats shall be not less than twenty inches in width, measured at the top of the seat backs.

Rows of seats shall be not less than two feet eight inches from back to back.

No bank of seats shall be of greater rise than twenty-two inches.

All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided, however, that groups of five seats or less may abut upon a tunnel at one side and an aisle at the other side.

The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle.

The number of banks of seats in the balcony shall not exceed nine unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

Sec. 511. **(Tunnels.—Cross Aisles.—Vertical Rise.)**—There shall be no more than twelve feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at such elevation of twelve feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

Sec. 512. **(Foyer.)**—No foyer shall be open to the theater proper except through the exits.

Sec. 513. **(Main Floor.—Balcony and Gallery.—Designation of.)**—The lower floor of all theaters shall be designated the "Main Floor."

Where there are balconies or galleries, the first balcony or gallery shall be designated the "Balcony" and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be printed plainly on all admission tickets.

Sec. 514. **(Aisles, Corridors and Passageways.—Kept Unobstructed.)**—The minimum width of aisles with diverging sides in any room or auditorium used for the purposes of Class V. shall be two feet eight inches at the end near the stage and not less than three feet at the other end.

The minimum width of aisles with parallel sides shall be three feet.

Every aisle shall lead as nearly as possible directly to an exit, but in no case shall the center line of such exit be more than three feet from the center line of any such aisle leading thereto.

Sec. 515. **(Steps in Aisles.)**—Steps shall not be permitted in aisles except as extending from bank to bank of seats and no riser shall be greater than seven and three-eighths inches, and no tread shall be less than nine and one-half inches, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane, and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together and a light shall be maintained so that every place where there are steps in inclosing aisles or corridors shall be clearly lighted.

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Sec. 516. **(Aisles Passageways, Corridors and Exits.)**—All aisles, passageways, corridors and exits shall be free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisles, passageway, corridors or exits during any performance, service, exhibition, lecture, concert or any public assemblage.

Sec. 517. **(Corridors, Passageways, Hallways and Doors.—Width Of.)**—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridor shall be anywhere less than four feet in width, and no door less than three feet wide, except as otherwise herein provided.

All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, check room or private office, shall permit of free passage, without returning to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part except by doors, not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

Sec. 518. **(Doors.—Entrance.)**—The entrance door to every theater shall be of sufficient width to accommodate the entire audience, computed on the basis of twenty inches in width in the clear to each hundred permanent seats, and in addition thereto a proportionate part of twenty inches for a fractional part of each one hundred seats in the audience room or auditorium.

No mirrors shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor, when no such doorway, exit, hallway or corridor is really in existence, nor shall there be any false doors or windows giving the appearance of an opening where none really exists.

Walls.—Ledges.—See Section 997.

Doors and Windows.—When Required to be Closed.—Fire-resisting Glass.—See Section 1049.

Sec. 519. **(Emergency Exits.—Width.—Emergency Stairs.—Width.—Emergency Exits Inside Walls of Buildings.—Fire Escapes.—Construction.—Fire Escapes Leading to Street or Alley.—Doors Open Outward.)**—Emergency exits and stairways shall be provided separately for each floor, balcony and gallery. They shall be of the same aggregate width as that provided for the main exits, and no emergency exit, doorway or stairway shall be less than three feet in width. Such emergency stairways shall be made of iron, steel or other incombustible materials. Such emergency exits shall be kept free of obstructions of any kind, including snow and ice.

Such emergency exits and stairways may be built inside the walls of the building, provided they are surrounded by a fireproof partition not less than four inches thick separating the exits and stairways from the audience room or auditorium.

If such emergency exits lead outside the building, all openings leading thereto shall have metal frames filled with fire-resisting glass doors opening outward hung from the inside corner of the jambs, and so constructed as not to project, when opened, beyond the outside face of wall, and outer shutters shall not be permitted.

Whenever any such emergency stairway passes over an exit door or window or other opening, such stairway shall be completely inclosed for a space of five feet greater in width than such opening by iron, steel or other incombustible material.

All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley and direct and immediate exit to such public thoroughfare shall not be obstructed by any doors, gates, bars or other obstruction of any character.

Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street, without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

All doors in openings from any and all stairways shall be so constructed that when opened they shall not obstruct any portion of any other doorway, opening or passageway.

All doors affording ingress to or egress from any theater shall open outward upon suitable hinges.

Sec. 520. **(Exit Doors.—Particulars as to.)**—Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time such theater is open to the public, so as to prevent them from being easily opened outwardly; and such door shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

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Sec. 521. **(Wall.—Brick Proscenium Wall Between Auditorium and Stage.—Steel Curtain Fireproofed on Stage Side.—No Combustible Material on Audience Side.—Plans for Curtain.—Permit from Building Department.—Inspection.—Fee.)**—There shall be in every theater a solid brick wall of the same construction and thickness as is required in outside walls between the auditorium and the stage. The main proscenium opening shall have a substantial steel curtain vertically operated and fireproofed on the stage side, which shall be raised and lowered by mechanical power and which shall be in constant use as the regular curtain and act drop.

No combustible material other than painted decorations shall be applied to the audience side of such curtains.

Plans for such curtain shall be approved by the building department and a permit obtained for its erection. The building department shall inspect such curtain semi-annually, for which inspection a fee of two (2) dollars shall be charged.

All other opening in such proscenium wall shall have iron doors, frames and thresholds.

Sec. 522. **(Stage Construction Of.—Fireproof Paint.—Scenery.—How Treated.)**—The framing of the floor of every stage shall be of iron or steel. The stage floor may be of wood, but shall not be less than two and three-fourths inches thick. The entire floor construction and floor of fly galleries, rigging lofts and paint gallery, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports shall be of iron or steel. All woodwork, including the under side of floor boards, and all framing for scenery used on or about the stage shall be coated with a fireproof paint, the qualities of which shall be submitted to and approved by the Commissioner of Buildings. All wood used for floor and floor supports shall be coated on the under side with the same kind of paint.

No scenery or stage paraphernalia of any sort shall be used upon the stage of any room used for the purposes of Class V., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

Sec. 523. **(Vestibule of Stage Doors.)**—All doorways or openings in the rear or sides of the stage shall be vestibuled or protected in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

Sec. 524. **(Vents, Flue Pipes, Size of.—Dampers.—Switches for Dampers.)**—One or more vents or flue pipes, of metal construction, or other incombustible material suitable for carrying away smoke, approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls and shall be continued and run up on the exterior of the building to a point five feet above the highest point of such additional stories.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery approved by the city electrician; such dampers shall be controlled by two switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station on the opposite side of the stage; such switches shall be located at such places on the stage as are designated by the fire marshal, and each shall have a sign with plain directions as to the operation of same printed thereon.

All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switchboards.

Sec. 525. **(Automatic Sprinklers.—Location Of.—Tank.—Connections.)**—There shall be provided approved system of automatic sprinklers, with approved automatic closed circuit electric devices connecting the valves regulating the flow of water in the various sprinkler pipes, with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes without automatic notice to the fire department.

Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the fireman provided for in this chapter to include in his daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, storeroom, property room, scene storage room, carpenter shop and dressing rooms, if such

rooms are in or connected with a building used for the purposes of Class V., such tank shall not be connected with a standpipe and ladder system, but shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building, with Siamese connections for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

Sec. 526. **(Fire Apparatus on Stage.—Hand Fire Pumps.—Fire Materials.—Hot Air Furnaces.)**—A standpipe not less than two and one-half inches in diameter, having a hose valve or valves thereon, shall be installed on each side of the stage, with a hose connection at the stage and at each level above and below the stage, and hose connected thereto at each valve ready for use at all times. Such standpipe shall be connected with a tank on the roof containing not less than three thousand gallons of water, protected from frost, and also with a power pump, all of which shall be subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall always be kept ready for use on and under the stage; in fly galleries and in rigging lofts, and in addition thereto at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

The use of ordinary hot air furnaces or stoves is prohibited.

Sec. 527. **(Exits.—Diagram Of, Printed on Program.)**—It shall be the duty of the owner, lessee or manager of any theater, for any performance in which programs are issued, to cause to be printed on such programs, on the page opposite that upon which the cast is printed, a diagram showing conspicuously all exits of such building. A diagram of seats of each floor, and the exits leading from each floor drawn to a scale of one-eighth inch to the foot, shall be hung in a frame within two feet of the ticket seller's window and so as to be easily seen by the public.

Sec. 528. **(Lighting.—Independent Lighting System for Exits.—Red Light Over Exits.)**—All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building and shall be in operation during the entire period such theater is open to the public and until the audience has left the building. The word "EXIT" shall be in letters at least six inches high over the opening to every means of egress from such theater and a red light furnished by gas or sperm oil shall be kept burning over such word "EXIT" at every such opening, during the entire period such theater is open to the public and until the audience has left the building.

Sec. 529. **(Fire Alarm Apparatus.)**—Every theater shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph, and such other place or places as the Fire Marshal may direct. The number and location of the boxes and the character of the system, whether automatic or manual, or both, shall be determined by the Fire Marshal.

Sec. 530. **(Firemen.—Employment Of.—Duties.)**—It shall be the duty of every person or corporation conducting, maintaining or operating a theater, to employ one competent, experienced fireman, who shall be detailed by the Fire Marshal from the regular City Fire Department; shall be in the uniform of the Chicago Fire Department; shall be on duty at such theater during the whole time it is open to the public; he shall report to and be subject to the orders of the Fire Marshal; and shall see that all fire apparatus required by this chapter is in its proper condition, ready for use; all exit doors unlocked during the whole time such theater is open to the public and all in efficient and ready working order.

The compensation to be paid the city for the services of such city fireman so detailed and employed shall be based on the regular salary paid by the city to such fireman, and shall be computed according to the ratio between the number of hours such fireman is employed at such theater and the total number of hours such fireman is employed by the city for all purposes.

It shall also be the duty of every person or corporation conducting, maintaining or operating a theater, to employ, in addition to the fireman employed by such persons and detailed by the fire marshal, one other experienced and competent person as a private watchman or fireman, who shall be approved by the Fire Marshal; and who shall be in distinctive uniform; and shall be on duty at such theater during the whole time it is open to the public; such private watchman or fireman shall report and be subject to the orders of the Fire Marshal, and it shall be his duty to see that the provisions of this chapter are complied with in all portions of the theater occupied and used by the public; and that all exit doors are unlocked during the whole time such theater is open to the public and in efficient and ready working order. The city fireman and Fire Marshal shall require a drill of the employes of such theater, including such

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private watchman or fireman, in the use of all apparatus and appliances for the prevention of fire inside the building and the saving of life, at least twice in every week, and such city fireman shall report to the fire marshal the manner and efficiency of such drill. Such city fireman shall report in writing, daily, to the fire marshal the condition and equipment of the theater to which he is detailed. No city fireman shall be on duty at any one theater for a longer period than two (2) weeks.

Sec. 531. **(Amusement License.)**—The amusement license issued for each theater shall state the number of permanent seats the theater contains, which number shall be governed by the provisions of this ordinance relating thereto, and no more than that number of persons shall be permitted to be in such theater at any one time.

No license for the operation of a theater will be issued unless the Commissioner of Buildings, Fire Marshal and the City Electrician shall first have certified, in writing, that such theater complies with the provisions of this chapter in every respect. respect.

Sec. 532. **(Lighting.—All Parts Well Lighted During Performances.)**—Every portion of any theater devoted to the use or accommodation of the public and all outlets therefrom leading to the streets, including all open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

Sec. 533. **(Lights.—Control of Lights in Halls, Corridors and Lobbies.—Separate Shut-off.—Connections with Gas Mains.—Independent Connections.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Footlights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air from Lights.—Gas Stage Lights to Have Metal Screens.)**—All gas or electric lights in the halls, corridors, lobbies or any other part of any theater used by the audience, except the auditorium, shall be controlled by a separate shut-off, located in the lobby, and controlled only in that particular place. Gas mains supplying such theater shall have independent connections for the auditorium and the stage, and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass in the auditorium, or in any other part of the theater, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceilings, or in any part of the theater, unless protected by fireproof materials. In case gas is used the footlights, in addition to the wire network, shall be protected by a strong wire guard not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of and surrounded by fireproof material. All border lights shall be constructed according to the best known method, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire rope. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. All gas stage lights shall have strong metal wire guards or screens not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and guards or screens shall be soldered to the fixtures in all cases.

The use of calcium lights in any theater is prohibited. All arc lights used on the stage shall at all times be subject to the approval of the city electrician, and no arc lights shall be used on any stage unless approved by said city electrician.

Sec. 534. **(Fire Apparatus.—Under Control of Fire Department.)**—The standpipes, automatic sprinklers, gas pipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtain, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against the same, as provided for by this chapter, shall be made and kept at all times in condition satisfactory to and under the control of the Fire Marshal.

Sec. 535. **(Officers Empowered to Enter Buildings.)**—The Commissioner of Buildings, Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any buildings used wholly or in part for the purposes of Class V., and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings; to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them, or any of them, in the performance of their duties.

Sec. 536. **(The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police Shall Close Buildings for Violations.)**—The Commissioner of Buildings, Fire Marshal, City Electrician and the Superintendent of Police, or any one of them, shall have the power and it shall be their joint and several duty,

to order any building used wholly or in part for the purposes of Class V., closed, where it is discovered that there is any violation of any of the provisions of this chapter and keep same closed until such provisions are complied with.

Sec. 537. (License.—Mayor Shall Revoke.)—Upon a report to the Mayor by the Commissioner of Buildings, Fire Marshal, City Electrician or the Superintendent of Police that any requirement of this chapter, or that any order given by them or any of them in regard thereto has been violated, or not complied with, the Mayor shall revoke the license of any such theater or place of amusement so reported and cause the same to be closed.

Buildings of Class V. Hereafter Erected.

Sec. 538. The following provisions shall apply to buildings hereafter erected and used wholly or in part for the purposes of Class V.

Sec. 539. (Walls.—Outside Walls.—Structures Built Above.)—The outside walls of all such buildings, the roofs or ceilings of which are carried on trusses or girders of a span of fifty feet or more, shall be as follows:

If such walls are less than twenty-five feet high they shall not be less than twenty inches thick.

If they are more than twenty-five feet and less than forty-five feet high they shall be not less than twenty-four inches thick.

If they are more than forty-five feet and less than sixty feet high they shall be not less than twenty-eight inches thick.

If they are more than sixty feet and less than seventy-five feet high they shall be not less than thirty-two inches thick.

If they are more than seventy-five feet and less than ninety feet high, they shall be not less than thirty-six inches thick.

An increase of four inches in thickness of such walls shall be made in all cases where they are over one hundred feet long without cross walls of equal height.

The thickness of the enclosing or surrounding walls of rooms used for the purposes of Class V., where such rooms are less than fifty feet wide, may be reduced by four inches.

If one or more stories are built above any room devoted to the uses of Class V., and such stories are carried on trusses or girders, the thickness of walls shall be increased by four inches for each two stories or part thereof above such room.

If solid masonry buttresses are employed and placed eighteen feet or less apart, and extended to the foot of the trusses or girders carrying the ceiling, or if iron or steel columns are inserted in such walls for the support of the superstructure, and at distances not more than twenty-four feet between centers,, and if such columns extend to and carry the superimposed trusses or girders, the thickness of such walls may be reduced in proportion to the increase of strength afforded by such buttresses or columns, but in no case shall any such wall be less than twelve inches thick in the top story, and four inches shall be added, going downward, for each story, for each gallery, or for each twenty-five feet in height of wall.

Sec. 540. (Columns in Walls.)—If iron or steel columns are introduced in such walls, the brickwork around such columns shall be bonded into the brickwork of the connecting wall, and each of such columns shall be fireproofed, as provided in Section 912 of this chapter.

Walls Around Stairs, Elevators and Shafts.—See Section 998.

Sec. 541. (Construction.—Frontage.—Open Spaces and Enclosed Passages.)—All buildings hereafter erected and used wholly or in part for the purposes of Class V. shall be built entirely of fireproof construction and shall be located so that they adjoin at least two public thoroughfares, one of which shall be a public street, and the other may be a public alley not less than ten (10) feet in width.

All floors, balconies and galleries of the audience room of every theater shall have open spaces or fireproof passageways on the three sides other than the proscenium; and on each of the two opposite sides other than the back and proscenium of every stage there shall be open spaces or fireproof passageways, and such open spaces or fireproof passageways shall open on or connect directly with the public thoroughfare.

All open spaces shall not be less than ten (10) feet in width and all fireproof passageways shall not be less than eight (8) feet in width, and shall be outside of the audience room, and shall be kept and maintained free and clear of obstruction of any and all kinds at any and all times.

All open spaces shall be open and unobstructed from the floor or pavement of such space to the sky, with the exception that emergency stairs and emergency balconies may be built in such open spaces. The entire floor of every open space shall be level or inclined; the incline shall not exceed two (2) inches in height for each one foot of horizontal measurement.

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If one or more fireproof passageways are required on one side of the stage, then the fireproof passageways of each floor and the balcony and each gallery of the audience room shall be continued through the stage house as fireproof passageways to an open space or public thoroughfare, and from the end of each such fireproof passageway there shall be doors or stairs, or both, which shall be arranged so as to afford a safe exit for the audience of such theater to the pavement of the public thoroughfares, and if fireproof passageways are required on both sides of the stage, then they shall be arranged and connected with all of the fireproof passageways on both sides of the audience room in the same manner as described for fireproof passageways when these are required only on one side of the stage.

The fireproof passageways for the main floor may pass under the stage floor.

Provided, however, that where there is no public thoroughfare or open space at the back of the stage and on one side of the stage, then the fireproof passageways for the main floor shall be on the stage floor and shall be built along that side of the stage on which there is no public thoroughfare and across the back of the stage to one of the public thoroughfares, and the fireproof passageways for the balcony and the fireproof passageways for the galleries shall each be built along the side of the stage and across the back of the stage, in a continuation of the balcony and gallery floor level to a public thoroughfare.

The fireproof passageways of the different floors, of the balcony and of the galleries, shall be independent of each other and shall not be connected with each other in any manner.

No doors or other openings except entrance doors from the audience room or exit doors to a thoroughfare shall be in the walls of a fireproof passageway; and all such doors shall be so arranged that when open they shall not obstruct the passage.

The walls of a fireproof passageway shall be not less than four (4) inches thick, and each and every part of such passageway, including each and all of its supports, shall be built of fireproof construction as required in the General Provisions relating to fireproof construction of this chapter.

Radiators for warming passageways shall be in recesses.

There shall be no steps or risers in a fireproof passageway, but where necessary inclined floors of the full width of the fireproof passageways may be built; the incline of the floor shall not exceed two and one-half (2½) inches in height per foot, measured horizontally, and no such incline shall be less than ten (10) feet in length. No fireproof passageway shall be less than eight (8) feet high in any part thereof, except at doors, and these shall not be less than seven (7) feet high.

If the principal entrance corridor of a theater is at one side of the audience room, then the center line extended of such principal entrance shall intersect the center axis of the stage and the audience room between the back of the seat most remote from the stage on said center axis of the stage and the audience room, and a point midway between such seat and the wall opposite the proscenium wall.

Sec. 542. **(Construction.)**—All such buildings shall be built entirely of fireproof construction.

Sec. 543. **(Buildings of Other Classes Built in Conjunction With Class V.—Construction of.)**—If buildings used wholly or in part for purposes of Class V. are built in conjunction with or as part of buildings devoted to the uses of other classes, then such buildings of other classes shall be built entirely of fireproof construction.

Sec. 544. **(Floor Levels.—Limitation Of.)**—In all cases where the floors of the auditorium of any theater in any such building of Class V. are banked or stepped up, the floor level of the lowest bank shall not be above the sidewalk level.

All floors shall be designed and constructed in such manner as to be capable of bearing in all their parts, in addition to the weight of floor construction, permanent fixtures and mechanisms that may be set upon the same, a live load of one hundred pounds for every square foot of surface in such floors.

The audience room or rooms or auditorium or auditoriums used for the purposes of Class V. containing, in the aggregate, not more than five hundred seats, if in a fireproof building, may be located in any story thereof, but in such case there shall be at least two separate stairways from the floor or floors in which such audience room or auditorium is located to the ground, each of which stairways shall be not less than four feet in width in the clear.

Sec. 545. **(Stairways.—Entrances and Exits.)**—Stairways affording ingress to or egress from any room used for the purposes of Class V. shall be in width equivalent to twenty inches for every one hundred of seating capacity of such room, and for fractional parts of one hundred a proportionate part of twenty inches of width shall be added, but in no event shall any such stairway be less than four feet wide in the clear, except as hereinafter provided.

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All such stairways shall have hand railings on each side thereof, and shall not ascend a greater height than thirteen feet six inches without a level landing, and the length and width of such landing shall be not less than the width of the stairs; no run of stairs shall consist of less than six risers between platforms, and risers shall not be placed on return platforms. Stairways which are over seven feet wide shall have double intermediate handrails with end newel posts at least five and a half feet high.

Steps shall not have a greater rise than seven and three-eighths inches, treads shall not be narrower than eleven inches, and winders shall not be used on any staircase.

Each and every balcony and gallery shall have separate and distinct entrances and stairways from the sidewalk level. The bottom run of the stairs shall be directly toward the street. Such stairs may ascend from the vestibule or entrance inside of the building, but the bottom riser of such stairs shall be not more than sixty-five feet from the building line. All doors between such stairs and the street shall be kept unlocked and unfastened during each and every performance and until the audience has left the building.

There shall be an iron stairway or stairways from the stage to the fly gallery and gridiron, continuing to the roof of the building or to some fireproof passageway or exit. Such stairways may be circular. Such circular stairways, however, shall not be used for access to the dressing rooms.

Stairs leading to a box or boxes seating not to exceed thirty people in the aggregate shall be independent of all other stairs and seats, and not less than two feet eight inches wide in the clear. For each additional twenty-five of seating capacity or major portion thereof in such box or boxes there shall be an additional five inches in width of such stairway.

All stairways on the stage side of the proscenium wall shall be not less than two feet six inches wide.

Sec. 546. **(Floors at Exits.)**—Floors at all exits shall be so designed as to be level and flush with adjacent floors and shall extend for an unbroken width of not less than four feet in front of each exit, and shall be two feet wider than such exit.

Sec. 547. **(Seating.)**—More than ten seats in any one row between aisles shall not be lawful.

Seats shall be not less than twenty-two inches in width, measured at the top of the seat backs.

Rows of seats shall not be less than two feet ten inches from back to back.

No bank of seats shall have a greater rise than twenty-two inches.

All groups of seats shall be so arranged that there shall be an aisle at each side of each group, provided groups of five seats or less may abut upon a tunnel at one side and an aisle at the other side.

The number of banks of seats on the main floor shall not exceed fifteen, unless an intervening or cross aisle is provided between each fifteen banks of seats or a direct exit is provided for each aisle. The number of banks of seats in the "balcony" shall not exceed nine, unless an intervening or cross aisle is provided between each nine banks of seats or a direct exit is provided for each aisle.

Sec. 548. **(Tunnels.—Cross Aisles.—Vertical Rise.)**—There shall be no more than eleven feet rise, measured vertically, in any aisle in any gallery without a direct exit by tunnel or otherwise, to a corridor with free opening on to the gallery stairs or other direct discharge to the street, or at any such elevation of eleven feet an intervening or cross aisle leading directly to an exit. No tunnel shall be less than three feet wide in the clear.

Sec. 549. **(Foyer.)**—No foyer shall be open to the theater proper except through the exits.

Sec. 550. **(Main Floor.—Balcony and Gallery.—Designation Of.)**—The lower floor shall be designated the "Main floor."

Where there are balconies or galleries the first balcony or gallery shall be designated the "Balcony," and the second and third balcony or gallery shall be designated, respectively, "Gallery" and "Second Gallery." Such designation shall be printed plainly on all admission tickets.

Sec. 551. **(Aisles and Passageways.—Kept Unobstructed.)**—The minimum width of aisles with diverging sides in any room or auditorium used for the purposes of Class V. shall be two feet eight inches at the end near the stage, and not less than three feet at the other end.

The minimum width of aisles with parallel sides shall be three feet.

Every aisle shall lead directly to an exit.

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Sec. 552. **(Steps in Aisles.)**—Steps shall not be permitted in aisles except as extending from bank to bank of seats, and no riser shall be more than seven and three-eighths inches in height, and no tread shall be less than ten inches in width, and whenever the rise from bank to bank of seats is less than five inches, the floor of the aisles shall be made as an inclined plane; and where steps are placed in outside aisles or corridors they shall not be isolated, but shall be grouped together, and a light shall be maintained so that every place where there are steps in enclosing aisles or corridors shall be clearly lighted.

Sec. 553. **(Aisles.—Passageways.—Corridors.—Exits.—To Be Kept Unobstructed.)**—All aisles, passageways, corridors and exits shall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any such aisles, passageways, corridors or exits during any performance, service, exhibition, lecture, concert or at any public assemblage.

Sec. 554. **(Corridors.—Passageways.—Hallways and Doors.—Width Of.)**—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that hereinbefore provided for stairways, excepting, however, that no corridors shall be anywhere less than four feet in width and no doorway less than three feet wide, except as otherwise herein provided.

All corridors, passageways, hallways and stairways leading from any balcony or gallery to any toilet room, retiring room, smoking room, cloak room, check room or private office shall permit of free passage, without returning, to an outer exit of the building. Such corridors, passageways, hallways and stairways shall be at least three feet in width in every part between such balcony or gallery and such outer exit, and shall be unobstructed in every part, except by doors not less than three feet in width in the clear, which shall swing outward and which shall not be provided with locks or catches of any kind whatever.

Sec. 555. **(Doors.—Entrance.)**—The entrance doors to every theater shall be of sufficient width to accommodate the entire audience, computed on the basis of twenty inches of width in the clear to each one hundred permanent seats or proportionate part thereof in the audience room or auditorium of such theater, and all doors shall be so arranged that when open they shall not obstruct any corridor or passage whatsoever into which they open.

No mirrors shall be so arranged as to give the appearance of a doorway, exit, hallway or corridor, when no such doorway, exit, hallway or corridor is really in existence, nor shall there be any false doors or windows giving the appearance of an opening where none really exists.

Sec. 556. **(Emergency Exits Width.—Emergency Stairs, Width.—Emergency Exits Inside Walls of Buildings.—Fire Escapes, Construction.—Fire Escapes Leading to Street or Alley.—Doors Open Outward.)**—Emergency exits and stairways shall be provided separately for each floor, balcony or gallery. They shall be of the same size as that provided for the main exits, and no emergency exit, doorway or stairway shall be less than three feet in width. Such emergency stairway shall be made of iron, steel or other incombustible material. Such emergency exit shall be kept free of obstructions of any kind, including snow and ice.

Such emergency exits and stairways may be built inside the walls of the building, provided they are surrounded by a fireproof partition not less than four inches thick, separating the exits and stairways from the audience room or auditorium.

If such emergency exits lead outside the building, the openings leading thereto shall have metal door frames and metal doors with panels filled with fire-resisting glass, opening outward, hung from the inside corner of the jambs, and so constructed as not to project when opened beyond the outside face of the wall, and outer shutters shall not be permitted.

Whenever any such emergency stairway passes over an exit or door or window or other opening, such stairway shall be completely enclosed for a space of five feet greater in width than such opening, by iron, steel or other incombustible material.

All such emergency exits and stairways shall land at the ground level in a public thoroughfare or in some space that connects directly with a street or alley, and direct and immediate exit to such public thoroughfare shall not be obstructed by any door, gate, bars or other obstruction of any character.

Every court in which there is an emergency stairway shall have direct and unobstructed access along the surface of the ground to a street, alley or yard opening into an alley or street without entering into or passing through or over any building unless by a four-foot wide fireproof passage on the court or ground level.

All doors in openings from emergency exits and stairways shall be so constructed that when opened they will not obstruct any portion of any other doorway, opening or passageway.

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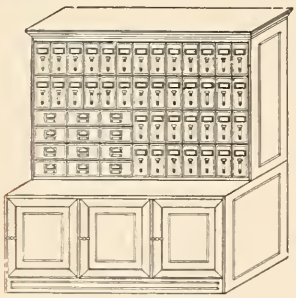

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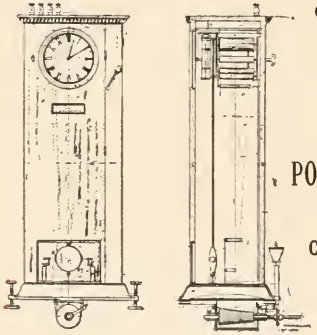

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All doors affording ingress to or egress from any theater shall open outward upon suitable hinges.

Exit doors shall not be obscured by draperies and shall not be locked or fastened in any manner during the entire time such theater is open to the public, so as to prevent them from being easily opened outwardly; and such doors shall be so constructed and maintained as to require no special knowledge or effort to open them from the interior.

Sec. 557. **(Wall.—Brick.—Proscenium Between Auditorium and Stage.—Steel Curtain Fireproofed on Stage Side.—No Combustible Material on Audience Side.—Plans for Curtain.—Permit from Building Department.—Inspection Fee.)**—There shall be a solid brick wall of the same construction and thickness as is required in the outside walls of the building in which such theater is located between the auditorium and the stage.

The main proscenium opening shall have a vertically operated steel curtain which shall, when it is lowered, completely close such prescenium opening. The curtain shall be raised and lowered by mechanical power, other than hand power, as the regular curtain and act drop each and every time there is an audience in the theater.

The lowering of the curtain shall be controlled from not less than two points in the building, one of which shall be designated by the Commissioner of Buildings.

The curtain shall have a steel covering on the outer (or auditorium) side. The stage side covering shall be of a non-conducting substance of such a thickness and such material as shall stand a test of two thousand degrees F. on the stage side for fifteen minutes and without heating the opposite side to a higher temperature than three hundred and fifty degrees F.

All metal work with the exception of the frame shall be covered with the non-conducting substance on the stage side.

The curtain shall operate vertically in steel guides of such a cross section that the edges shall engage and secure the edges of the curtain and prevent the curtain from leaving the guiding channel or channels if the curtain should tend to buckle or bag either inward or outward. No metal in the guide channels or in the engaging edge of the curtain shall be less than three-eighths (⅜) of an inch thick. The joints of the curtain with the proscenium wall, with the stage floor and with the head of the opening shall be made gas tight as nearly as practicable.

The calculations for the strength of the curtain, the curtain guides and the guide anchors, and the workmanship shall be according to the best modern engineering practice, the stresses in the material and in the various sections of steel shall be within the safe limits of stress described in this ordinance.

No part of a curtain or of the curtain guides shall be supported by or fastened to any combustible material.

The supports of the curtain and the curtain guides and edges and the curtain shall be of sufficient strength to safely resist a pressure of twenty (20) pounds for each and every square foot of the curtain either inward or outward, if such curtain does or does not bag.

No combustible material other than painted decorations shall be applied to the audience side of any such curtain.

Plans for every such curtain shall be approved by the Building Department and a permit obtained for its erection. The Building Department shall inspect such curtain semi-annually, and for each such inspection a fee of two (2) dollars shall be charged.

All other openings in such proscenium wall shall have self-closing, regulation standard iron fire doors and iron frames and thresholds; such doors and frames shall be built in such a manner as to resist warping.

Sec. 558. **(Stage, Construction of.—Fireproof Paint.—Scenery.—How Treated.)**—The framing of the floor of every stage shall be of iron or steel or fireproof material. The stage floor may be of wood, but shall not be less than two and three-fourths inches thick. The entire floor construction and floor of fly galleries, rigging lofts and paint galleries, all railings and supports and stanchions thereon, and all sheaves, pulleys and cables and their supports shall be of iron or steel. All woodwork, including the under side of floor boards, and all framing for scenery used on or about the stage shall be coated with a fireproof paint, the qualities of which shall be submitted to and approved by the Commissioner of Buildings. All wood used for floor and floor supports shall be coated on the under side with the same kind of paint.

No scenery or stage paraphernalia of any sort shall be used on the stage of any room used for the purposes of Class V., unless such scenery and paraphernalia shall have been treated with a paint or chemical solution which shall make it non-inflammable, and which treated scenery or stage paraphernalia, or both, shall be tested and approved by the Fire Marshal.

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Sec. 559. (Vestibules for Stage Doors.)—All doorways or openings in the rear or sides of the stage shall be vestibuled or protected in a manner satisfactory to the Commissioner of Buildings, so as to protect the curtain, scenery and auditorium against draughts of air.

Sec. 560. (Structures Over Ceiling.—Construction.)—If any structure is built over the ceiling or roof of any theater, the different members of the girders or trusses supporting same shall have their fireproofing double, in the manner prescribed for columns of fireproof buildings as specified in the General Provisions of this chapter.

Sec. 561. (Vents, Size Of.—Flue Pipes.—Dampers.—Switches for Dampers.)—One or more vents or flue pipes of metal construction, or other incombustible material, suitable for carrying away smoke, and approved by the Commissioner of Buildings, and extending not less than fifteen feet above the highest point of the roof, and equivalent in area to one-twentieth of the area of the stage, shall be built over the stage.

In buildings where additional stories are built above the stage, such vents or flue pipes may be carried out near the top of the stage walls, and shall be continued and run up on the exterior of the buildings to a point five feet above the highest point of such additional story.

All such flues or vents shall be provided with metal dampers, and shall be opened by a closed circuit battery, approved by the City Electrician.

Such dampers shall be controlled by two switches, one at the electrician's station on the stage, which station shall be fireproof, and the other at the city fireman's station, on the opposite side of the stage; such switches shall be located in such places on the stage as are designated by the Fire Marshal, and each shall have a sign with plain directions as to the operation of the same printed thereon.

All fuse boxes shall be surrounded by two thicknesses of fireproof material, with an air space between, and no fuses shall be exposed to the air between the switchboards.

Sec. 562. (Automatic Sprinklers.—Location.—Tank.—Connections.)—There shall be provided an approved system of automatic sprinklers with approved automatic closed circuit electric devices connecting the valves, regulating the flow of water into the various sprinkler pipes with the headquarters of the city fire alarm telegraph, and such other place or places as the Fire Marshal shall direct, so arranged as to prevent any tampering with the system or the shutting off of the water from the sprinkler pipes without automatic notice to the fire department.

Such system of automatic sprinklers shall be supplied with water from a tank located not less than twenty feet above the level of the highest sprinkler head in the system, and it shall be the duty of the firemen provided for in this chapter to include in their daily report the result of an inspection to determine the sufficiency of water in this tank. Automatic sprinklers shall be placed in the paint room, store room, property room, scene storage room, carpenter shop and dressing rooms, if such rooms are in or connected with a building used for the purposes of Class V. Such tank shall not be connected with a standpipe and ladder system, but it shall be filled through a separate pipe from a fire pump, and a three-inch iron pipe shall extend from such tank to the outside of such building with Siamese connections for fire department use. Such entire automatic sprinkler system and equipment and the location thereof shall be subject to the approval of the Fire Marshal.

Sec. 563. (Fire Apparatus on Stage.—Hand Fire Pumps.—Fire Materials.—Hot Air Furnaces.)—A standpipe not less than three inches in diameter, having a hose valve or valves thereon shall be installed on each side of the stage with a hose connection at the stage and at each level above and below the stage, and hose connected thereto at each valve ready for use at all times. Such standpipes shall be connected with a tank on the roof containing not less than three thousand gallons of water, protected from frost, and such tank shall be connected with and supplied by a power pump, all of which shall be subject to the approval of the Fire Marshal. Portable fire extinguishers or hand fire pumps shall always be kept ready for use on and under the stage, in fly galleries and in rigging loft, and in addition thereto at least four fire department axes and six pike poles shall be kept ready for use on each tier or floor of the stage, all of which shall be subject to the approval of the Fire Marshal.

The use of ordinary hot air furnaces or stoves is prohibited.

Sec. 564. (Exits.—Diagram of.—Printed on Programs.)—It shall be the duty of the owner, lessee or manager of any theater, for any performance in which programs are issued, to cause to be printed on such programs on the page opposite that on which the cast is printed, a diagram showing conspicuously all exits of such build-

ing. A diagram of seats on each floor, and the exits leading from each floor, drawn to a scale of one-eighth inch to the foot, shall be hung in a frame within two feet of the ticket seller's window and so as to be easily seen by the public.

Sec. 565. **(Independent Lighting System for Exits.—Red Light Over Exits.)**—All stairways and corridors shall be supplied with a supplementary lighting system of electricity, gas or sperm oil, and such system shall be independent of all other lights in such building, and shall be in operation during the entire period such theater is open to the public and until the audience has left the building. The word "EXIT" shall be in letters at least six inches high over the opening to every means of egress from such theater and a red light, furnished by gas or sperm oil, shall be kept burning over such word "EXIT" at every such opening, during the entire period such theater is open to the public and until the audience has left the building.

Sec. 566. **(Fire Alarm Apparatus.)**—Every theater shall be provided with an approved system of automatic or manual fire alarm telegraph apparatus, connected by the necessary wires with the headquarters of the city fire alarm telegraph and such other place or places as the Fire Marshal shall direct. The number and location of the boxes and the character of the system, whether automatic or manual or both, shall be determined by the Fire Marshal.

Sec. 567. **(Firemen.—Employment of.—Duties of.)**—It shall be the duty of every person, or corporation, conducting, maintaining or operating a theater, to employ one competent, experienced fireman, who shall be detailed by the Fire Marshal from the regular City Fire Department; shall be in the uniform of the Chicago Fire Department; shall be on duty at such theater during the whole time it is open to the public; shall report to and be subject to the orders of the Fire Marshal; shall see that all fire apparatus required by this chapter is in its proper condition, ready for use; all exit doors unlocked during the whole time such theater is open to the public, and all in efficient and ready working order.

The compensation to be paid the city for the services of such city fireman so detailed and employed shall be based upon the regular salary paid by the city to such fireman and shall be computed according to the ratio between the number of hours such fireman is employed at such theater and the total number of hours such fireman is employed by the city for all purposes.

It shall also be the duty of every person or corporation conducting, maintaining or operating a theater, to employ, in addition to the fireman employed by such persons and detailed by the Fire Marshal, one other experienced and competent person as a private watchman or fireman, who shall be approved by the Fire Marshal; shall be in a distinctive uniform; shall be on duty at such theater during the whole time it is open to the public; shall report to and be subject to the orders of the Fire Marshal, and whose duty it shall be to see that the provisions of this chapter are complied with in all portions of the theater occupied and used by the public; shall see that all exit doors are unlocked during the whole time such theater is open to the public, and in efficient and ready working order. The city fireman and Fire Marshal shall require a drill of the employes of such theater, including such private watchman or fireman, in the use of all apparatus and appliances for the prevention of fire inside the building and the saving of life, at least twice in every week, and such city fireman shall report to the Fire Marshal the manner and efficiency of such drill. Such city fireman shall report in writing, daily, to the Fire Marshal the condition and equipment of the theater to which he is detailed. No city fireman shall be on duty at one theater for a longer period than two (2) weeks.

Sec. 568. **(Amusement License.)**—The amusement license issued for each theater shall state the number of permanent seats it contains, which number shall be governed by the provisions of this chapter relating thereto, and no more than that number of persons shall be permitted in such theater at any one time.

No license for the operation of a theater shall be issued unless the Commissioner of Buildings, Fire Marshal and City Electrician shall first have certified, in writing, that such theater complies with the provisions of this chapter in every respect.

Sec. 569. **(Lighting.—All Parts Well Lighted During Performances.)**—Every portion of any theater, devoted to the uses or accommodation of the public, and all outlets therefrom, to the streets, including open courts, corridors, stairways, exits and emergency exit stairways, shall be well and properly lighted during every performance, and the same shall remain lighted until the entire audience has left the premises.

Sec. 570. **(Lights.—Control of Lights in Halls, Corridors and Lobbies.—Separate Shut-off.—Connections With Gas Mains.—Independent Connections.—Protection of Suspended and Bracket Lights.—Protection of Lights Inserted in Walls.—Protection of Footlights.—Construction of Border Lights.—Ducts and Shafts Conducting Heated Air**

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from Lights.—Gas Stage Lights to Have Metal Screens.)—All gas or electric lights in the halls, corridors, lobbies or any other part of any theater used by the audience, except the auditorium, shall be controlled by a separate shut-off located in the lobby and controlled only in that particular place. Gas mains supplying such theater shall have independent connections for the auditorium and the stage and provision shall be made for shutting off the gas from the outside of the building. All suspended or bracket lights surrounded by glass, in the auditorium, or in any other part of the theater, shall be provided with proper wire netting underneath. No gas or electric lights shall be inserted in the walls, woodwork, ceiling, or in any part of the theater unless protected by fireproof materials. In case gas is used, for the footlights, in addition to the wire network, they shall be protected by a strong wire guard, not less than two feet distant from such footlights, and the trough containing such footlights shall be formed of and surrounded by fireproof material. All border lights shall be constructed according to the best known methods, and subject to the approval of the Fire Marshal and the City Electrician, and shall be suspended by wire ropes. All ducts and shafts used for conducting heated air from the main chandelier, or from any other light or lights, shall be constructed of metal and made double, with an air space between. All gas stage lights shall have strong wire metal guards or screens, not less than ten inches in diameter, so constructed that any material coming in contact therewith shall be out of reach of the flames of such lights, and shall be soldered to the fixtures in all cases.

The use of calcium lights in any theater is prohibited. All arc lights used on the stage shall be at all times subject to the approval of the City Electrician, and no arc lights shall be used on any stage unless approved by the City Electrician.

Sec. 571. (Fire Apparatus to Be Under Control of Fire Department.)—The standpipes, automatic sprinklers, gaspipes, electric wires, hose, footlights, fire alarm boxes, fireproof proscenium curtains, switch boxes, ventilators, controlling levers, axes and pike poles, and all apparatus for the extinguishing of fire or guarding against same, as provided for by this chapter, shall be made and kept at all times in condition satisfactory to and under control of the Fire Marshal.

Sec. 572. (Officers Empowered to Enter Buildings.)—The Commissioner of Buildings, Fire Marshal, City Electrician, Superintendent of Police, or any of them, and their respective assistants, shall have the right to enter any buildings used wholly or in part for the purposes of Class V., and any and all parts thereof, at any reasonable time, and at any time when occupied by the public, in order to examine such buildings and to judge of the condition of the same and to discharge their respective duties, and it shall be unlawful for any person to interfere with them or any of them in the performance of their duties.

Sec. 573. (The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police Shall Close Buildings for Violations.)—The Commissioner of Buildings, Fire Marshal, City Electrician or Superintendent of Police, or any of them, shall have the power and it shall be their joint and several duty to order any building used wholly or in part for the purposes of Class V. closed, where it is discovered that there is any violation of the provisions of this chapter, and to keep same closed until such provisions are complied with.

Sec. 574. (License.—Mayor Shall Revoke.)—Upon a report to the Mayor by the Commissioner of Buildings or Fire Marshal or City Electrician or the Superintendent of Police that any requirement of this chapter, or that any order given by them or any of them, in regard thereto, has been violated, or not complied with, the Mayor shall revoke the license of any such theater or place of public amusement so reported and cause the same to be closed.

ARTICLE IX.

PROVISIONS RELATING SOLELY TO CLASS VI.

Sec. 600. (Class VI.)—In Class VI. shall be included every tenement and apartment house; that is to say, any house or building, or portion thereof, which is used as a home or residence for two or more families living in separate apartments.

Sec. 601. (Walls of Class VI.—Thickness of.)—Buildings of Class VI. shall conform to the following requirements:

The thickness of enclosing walls of buildings of Class VI shall be made in accordance with the following table, to wit:

571 to 574—384 to 387 600-601—388

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	Basement.	STORIES 1	2	3	4	5	6	7	8	9	10	11	12
Basement and	12	8											
Two-story	12	12	8										
Three-story	16	12	12	12									
Four-story	20	16	16	12	12								
Five-story	20	16	16	16	12	12							
Six-story	20	20	16	16	16	12	12						
Seven-story	24	24	20	20	16	16	12	12					
Eight-story	24	24	24	20	20	16	16	12	12				
Nine-story	28	24	24	20	20	20	16	16	12	12			
Ten-story	28	24	24	24	20	20	20	16	16	12	12		
Eleven-story	28	28	24	24	24	20	20	20	16	16	12	12	
Twelve-story	32	28	28	24	24	24	20	20	20	16	16	12	12

Provided, however, in buildings of steel skeleton fireproof construction, thickness of walls shall be governed by the provisions of Section 911 of this chapter.

Walls Around Stairs, Elevators and Shafts.—See Section 998.

Walls.—Reinforced Concrete.—See Section 960.

Sec. 602. **(Definitions.)**—"New Tenement House" includes every tenement house hereafter in existence not now used as a tenement house, but hereafter converted or diminished in size or otherwise altered after its erection, and every building now or hereafter in existence not now used as a tenement house, but hereafter converted or altered to such use.

Sec. 603. **(Apartment.)**—"Apartment" is a room or suite of two or more rooms occupied or intended or designed to be occupied as a family domicile.

Sec. 604. **(Yard.)**—"Yard" is an open, unoccupied space on the same lot with a tenement house, separating every part of every building on the lot from the rear line of the lot.

Sec. 605. **(Court.)**—"Court" is an open, unoccupied space, other than a yard, on the same lot with a tenement house; a court entirely surrounded by a tenement house is an "inner court;" a court bounded on one side and both ends by a tenement house and on the remaining side by a lot line is a "lot line court;" a court extending to a street, alley or yard is an "outer court."

Sec. 606. **(Shaft.)**—"Shaft" includes exterior and interior shafts, whether for air, light, elevator, dumb waiter or any other purpose; a "vent shaft" is one used solely to ventilate or light a water closet compartment, bath room, or pantry.

Sec. 607. **(Public Hall.)**—"Public Hall" is a hall, corridor or passageway, not within an apartment.

Sec. 608. **(Stair Hall.)**—"Stair Hall" includes the stairs, stair landings, and those portions of the public halls through which it is necessary to pass in getting from the entrance floor to the top story.

Sec. 609. **(Basement.)**—"Basement" is a story partly, but not more than one-half—"Cellar" is a story more than one-half—below the level of the street grade nearest the building; where the grade of a street adjacent to a tenement house varies, the mean or average grade of such street opposite the lot containing the tenement house shall be regarded as the grade of such street within the meaning of this chapter.

Sec. 610. **(Story.)**—"Story" is that portion of a building between the top of any floor beams and the top of the floor or ceiling beams next above.

Sec. 611. **(Solid Masonry.)**—A good quality of brick, laid in lime mortar, of strength and character equal to the requirements of Section 996 of this chapter, for brick walls, shall be taken as the standard of strength and stability for "solid masonry," but any other fireproof materials of equal strength and stability to the above standard may be substituted for brick.

Sec. 612. **(Construction of.)**—Every new tenement house more than five stories and basement high shall be of fireproof construction (according to the definition of "fireproof construction" contained in Section 901 of this chapter); every new tenement house more than three stories and basement high, but not more than five stories and basement high, shall be of slow-burning or fireproof construction (according to the definition of "slow-burning or fireproof construction" as defined in this chapter). In case slow-burning construction be used the cellar and basement construction, including the floor construction of the first story above the cellar or basement, shall be of fireproof construction.

Sec. 613. **(Partitions Between Apartments in Frame Buildings to Be Incombustible.)**—In all new frame tenement houses outside the fire limits of the city, each

602 to 611—389 612-613—390

suite of apartments shall be separated from the next suite in such building by a wall of incombustible material of such character as the Commissioner of Buildings may require.

Sec. 614. **(Joists.—Supports for.)**—If in buildings of Class VI. the distance between the enclosing walls is more than twenty-four feet in the clear, there shall be intermediate supports for the joists, which supports shall be either brick walls or iron or steel. If brick walls are used for this purpose they may, in all cases where the thickness of walls is given in the table as 16 inches or more, be made 4 inches less in thickness than the dimensions stated in the table.

Walls.—Ledges in.—See Section 997.

Sec. 615. **(Fire Escapes.)**—Every tenement house four or more stories in height shall be provided with a fire escape or fire escapes, such as are required by the statutes of this state and the ordinances of the city. In every case each separate apartment shall have direct access to at least one such fire escape unless such apartment shall have direct access (without passing through any other apartment) to at least two separate flights of stairs leading to the ground, one of which is placed in front and one in the rear of such building, and one of which may be placed outside of the building; but where such separate apartment shall not have access to two such flights of stairs, then there shall be a metal stairway between the balconies of every such fire escape, securely fastened to the walls of the building not less than two feet wide, with a proper hand rail, instead of the usual vertical ladder. Every court in which there shall be a fire escape shall have direct and unobstructed access along the surface of the ground to a street, alley, or yard opening into the alley or street, without entering into or passing through or over any building, unless by a four-foot wide fireproof passage on the court or ground level.

Sec. 616. **(Fire Escapes to Be Painted.)**—Every new fire escape shall be painted with two coats of durable paint, one put on in the shop and the other at once upon the erection of such fire escape.

Sec. 617. **(Bulkheads and Scuttles.—Stairs to.)**—Every tenement house shall have in the roof a bulkhead or scuttle, fireproof or covered with fireproof materials, with stairs or ladder leading thereto; no such roof opening shall be less than two feet by three feet. No scuttle or bulkhead door shall have upon it any lock, but may be fastened on the inside by movable bolts or hooks.

Sec. 618. **(Stairs and Halls.—In Case of Alterations.—Requirements.)**—Every now existing and every new tenement house shall have at least two flights of stairs, which shall extend from the entrance floor to the top story. Such stairs and the public halls in every tenement house shall each be at least three feet wide in the clear, and every apartment shall be directly accessible from both such flights of stairs. If any existing tenement house be so altered as to increase the number of apartments therein, or if such building be increased in height, or if the halls and stairs therein be damaged by fire or otherwise to an extent greater than one-half the original cost thereof, the entrance, stair halls, entrance halls and other public halls of the whole building shall be made to conform to the requirements of this ordinance as to new tenement houses.

Sec. 619. **(Railings and Guards.)**—In every tenement house all stairways shall be provided with sufficient railings and guards.

Sec. 620. **(Stairs in Non-Fireproof Buildings, Eighty to One Hundred and Twenty Rooms.)**—Every new non-fireproof tenement house containing over eighty rooms, exclusive of bath rooms, shall have one additional flight of stairs (over and above the flights hereinbefore provided for) for every additional eighty rooms, or fraction thereof; but if such building contains not more than one hundred and twenty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be at least one-half wider than is provided in Sections 618 and 625 of this chapter.

Sec. 621. **(Stairs in Fireproof Buildings One Hundred and Twenty Rooms and Upward.)**—Every new fireproof tenement house containing over one hundred and twenty rooms, exclusive of bath rooms, shall have one additional flight of stairs over and above the flights hereinbefore provided for) for every additional one hundred and twenty rooms or fraction thereof; but if such building contains not more than one hundred and eighty rooms, exclusive of bath rooms, at the owner's option, in lieu of an additional stairway, the stairs and public halls throughout the entire building shall be made at least one-half wider than is provided in Sections 618 and 625 of this chapter.

Sec. 622. **(Stairs.—Entrance to.—Treads and Risers.)**—Every flight of stairs required in a tenement house shall have an entrance on the entrance floor from a street or alley, or from a yard or court which opens into a street or alley. All stairs

except rear stairs, in new tenement houses, shall have risers not more than seven and three-quarters inches high and treads not less than nine and one-half inches wide exclusive of nosings, except in winding stairs, where all treads at a point eighteen inches from the strings on the well side shall be at least nine and one-half inches wide, exclusive of nosings.

Sec. 623. **(Stairs and Stair Halls.—Over Three Stories.—Fire-Resisting Glass.)**—The stairs and stair halls in all new tenement houses more than three stories and basement high shall be constructed of incombustible material throughout, except that the treads of stairs (not less than one and three-fourths inches thick) and all hand rails, may be of hard wood. All windows in stair halls in new tenement houses more than three stories and basement high opening on inner courts or shafts shall be of good quality fire-resisting glass.

Sec. 624. **(Stair Halls Enclosed in Masonry.—Requirements.—Exceptions.)**—In every new non-fireproof tenement house all stair halls shall be inclosed on all sides with walls of solid masonry of the same dimensions and thickness as specified for enclosing walls. All glass in such stair halls shall be of good quality fire-resisting glass, except where same opens into a street, alley, outer court or yard. There shall be no movable transoms or sash openings from any such stair hall to any other part of the building. This section shall not apply to tenement houses which are not more than three stories and basement high, with only one apartment on each floor.

Sec. 625. **(Entrance Halls.—Solid Masonry.—Exceptions.—Ceilings.)**—Every main entrance hall in a new tenement house shall be at least three feet six inches wide in the clear from the entrance up to and including the stair enclosure, and beyond this point at least three feet wide in the clear. In every new non-fireproof tenement house, except where there is only one apartment on each floor, such entrance hall shall be inclosed with solid masonry walls and with ceilings covered with incombustible material and shall comply with all the conditions of the preceding sections of this chapter as to the construction of stair halls. If such main entrance hall is the only entrance to more than one flight of stairs, the several portions of such main entrance hall which separate the entrance of the building from the several flights of stairs respectively shall be increased respectively at least one foot in width for each additional flight of stairs.

Sec. 626. **(Frame Building Not to Be Enlarged.)**—No wooden frame tenement house within the fire limits shall be enlarged either by adding to its height or to its superficial area.

Sec. 627. **(Bay Windows.—Vent Shafts.—Openings.)**—All bay windows and all shafts and courts in new tenement houses shall have their walls of brick or other fireproof construction throughout. All openings in vent shafts as well as in shafts for light or ventilation, shall either have fireproof closing doors or else shall be glazed with fire-resisting glass; provided, however, that the above provisions of this section shall not apply to enclosures about elevators or in a well hole of stairs where the stairs themselves are enclosed in brick or stone walls and are constructed entirely of fireproof materials.

Sec. 628. **(Apartments Divided by Masonry.)**—There shall be a wall of solid masonry of the same thickness as required for outside walls in buildings of this character, extending from the ground to the roof between each set of apartments and around each well hole, court or light shaft; provided, however, that the wall between apartments above the first story extending from a main stair hall to the outer wall of the building may jog or set over to some point toward the center of the building to provide or allow for an even distribution of space of the rooms adjacent to the same; provided, however, that such wall above the first story, if supported on iron or steel beams (which shall extend from the brick wall surrounding the main stair hall to the outer wall of the building at each succeeding story), shall be not less than eight inches in thickness, but all brick walls between apartments and around each well hole, court or light shaft which extend from the ground to the roof and above the first story of an apartment building not supported as above described in this section, shall be of the thickness prescribed for buildings of this class in Section 601 of this chapter.

Sec. 629. **(Space Occupied on Lot.—Plat Measurements.)**—No new tenement house, alone or with other buildings now or hereafter erected, shall occupy above the first story more than eighty-five per centum of the area of a corner lot or more than ninety per centum of the area of such corner lot, if such corner lot is bounded on three sides by streets or alleys, or more than seventy-five per centum of the area of any other lot, provided, that the space occupied by fire escapes, constructed and

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erected according to law and not more than four feet wide, shall be deemed unoccupied.

At the time of applying for a permit for the erection of a new tenement house the applicant shall submit a plat of the lot showing the dimensions of the same and the position to be occupied by the proposed building, and the position of any other building or buildings that may be on the lot. The measurements shall in all cases be taken at the top of the first story and shall not include any portion of any street or alley.

Sec. 630. (Corner Lot Defined.—Frontages.—Triangular Lots.)—By corner lot is meant a lot situated at the junction of two streets or of a street and public alley not less than sixteen feet in width. Any portion of the width of such lot distant more than fifty feet from such junction shall not be regarded as part of a corner lot, but shall be subject to the provisions of this chapter respecting other than corner lots.

Where, in corner lots, the two frontages are of unequal length, the lesser street frontage shall be taken as the width of the lot. Street frontage alone and not alley frontage shall be considered in determining such lesser frontage. No existing tenement house shall hereafter be enlarged or its lot be diminished or other buildings be placed on its lot, so that after such change a larger proportion of any corner lot or other lot upon which it is situated is covered by buildings than the aforesaid proportions, respectively; provided, however, that in case of a lot triangular or irregular in shape, bounded on two or more sides by a street and having a number of lineal feet street frontage extending one-twentieth of the number of square feet in the area of such lot, it shall not be necessary to comply with the conditions of this section as to percentage of lot to be covered; and provided, further, that there shall be no violation of Section 634 of this chapter in the erection of any tenement house.

Sec. 631. (Fire Walls.—When Dispensed With.)—Fire walls of brick not less than twelve inches thick shall be built, extending above the roofs of all adjoining buildings, if such roofs are flat, and also where the building stands upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or where the building is not over three stories high, the fire walls may be eight inches thick. Such fire walls, where they stand upon lot lines or where they are over the dividing walls between buildings or over the dividing walls in the interiors of buildings, where such are called for by this chapter by reason of the great area of such buildings, shall extend at least two feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines, if the top of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of mortar or hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and material of the roof shall be made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 632. (Height.—How Measured.)—The height of a new tenement house shall not by more than one-half exceed the platted width of the widest street on which it abuts.

Provided, however, that any distance the building sets back from the lot line shall be added to the width of the street in making this computation, but no existing tenement house shall be increased beyond such height. Such height shall be the perpendicular distance from the grade nearest the house to the highest point of the roof (not including as part of the roof any cornice or bulkhead less than eight feet high, or any elevator enclosure less than sixteen feet high). Where such street grade varies, the mean or average grade thereof opposite such house shall be the datum from which such height shall be measured.

Sec. 633. (Alley or Yard in Rear.—Must Have.—Size of Yard Increased.)—At the rear of every lot containing a new tenement house (unless the rear of such lot abuts upon a public alley at least ten feet wide) there shall be a yard open and unobstructed from the earth to the sky, except by fire escapes not more than four feet wide, constructed and erected according to law; every part of such yard shall be directly accessible from every other part thereof; such yard shall on corner lots (as above defined) have an area of at least eight per centum of the superficial area of the lot, and shall on other lots have an area of at least ten per centum of the superficial area of the lot. Every such yard shall be increased one per centum of the superficial area of the lot for every story above three stories in the height of the tenement house situated

thereon, and in no case shall such yard separate any building on such lot by less than ten feet from the rear line of the lot at the nearest point of approach of such building to such rear line.

Sec. 634. **(Requirements in Case of Enlarging.—Distance Between Buildings.)**—No existing tenement house shall (unless the rear of the lot upon which it stands abuts upon a public alley at least ten feet wide) hereafter be enlarged or its lot be diminished so that any building on such lot shall at any point approach nearer than ten feet to the rear line of the lot. Where a tenement house, now or hereafter erected, stands upon a lot, other than a corner lot, no other building shall hereafter be placed upon the front or rear of that lot, unless the minimum distance between such buildings be at least ten feet, if neither building exceeds the height of one story; or fifteen feet, if either building exceeds the height of one story, but not the height of two stories; and so on, five additional feet to be added to such minimum distance of ten feet for every story more than one in the height of the highest building on such lot.

Sec. 635. **(Courts.—Porches.)**—Every court of every new tenement house shall be open and unobstructed at every point thereof from the bottom thereof to the sky, save by fire escapes or stairs or landings constructed and erected according to law and projecting not more than four feet into courts, which courts shall communicate directly without obstruction into a street, alley or yard. Where porches are constructed in courts, the amount of area of unobstructed space in such courts shall be exclusive of space occupied by stairs and porches. No rear porch shall be constructed which is more than eight feet in width where the construction is of combustible material, and no such rear porches shall be enclosed with other than incombustible material, as defined in Section 907 of this chapter.

Sec. 636. **(Rooms.—Habitable.—Windows.—Vent Shafts.)**—In every new tenement house every habitable room, excepting water closet compartments and bath rooms, shall have at least one window opening directly upon a street, alley, yard or court. The total area of the windows opening from any such room (other than water closet compartments and bath rooms) upon a street, alley, yard or court, shall be at least one-tenth of the floor area of that room, and the top of at least one window shall be not less than seven feet above the floor and the upper half of that window shall be made so as to open its full width. No window in any such room (other than pantries, water closet compartments and bath rooms) shall have less than ten square feet glass area, and in no such water closet compartment or bath room shall the total window area be less than three square feet glass area, or the width of any window less than one foot; and when any window ventilating any water closet compartment or bath room in any new tenement house opens into a vent shaft, no window from any room other than a water closet compartment, bath room, pantry or hall shall open into such vent shaft.

Sec. 637. **(Windows in Lot Line Walls.)**—Windows in addition to those provided for in Section 639 of this chapter, if placed in any lot line wall or in any wall nearer to the lot line than is specified in Section 639 of this chapter from such lot line, then the sash in such window shall be stationary and glazed with fire-resisting glass.

Sec. 638. **(Courts.—Inner.—Sizes Of.—Lot Line Courts.)**—The inner courts of all new tenement houses as defined in Section 605 of this chapter shall have areas and minimum widths in all parts not less than the widths and areas as follows:

Buildings.	Square Feet.	Least Width.
2 stories	100	6 feet
3 stories	120	7 feet
4 stories	160	8 feet
5 stories	250	12 feet
6 stories	400	16 feet
7 stories	625	20 feet
8 stories	840	24 feet

"Lot line courts" shall have areas and minimum widths in all parts not less than one-half of those specified in the above table of "inner courts."

Sec. 639. **(Courts.—Outer.—Sizes Of.—Width Increased.)**—The "outer courts" of all tenement houses defined in Section 605 of this chapter shall have not less than the following widths for their minimum in all parts:

Buildings.	Least Width.
2 stories	3 feet
3 stories	3 feet 6 in.
4 stories	4 feet
5 stories	6 feet

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Buildings.	Least Width.
6 stories	8 feet
7 stories	10 feet
8 stories	12 feet

If the outer or lot line court has windows on opposite sides of the same, the least widths given in the above table for outer courts shall be doubled.

Sec. 640. (Rooms.—Sizes and Height Of.—Attic and Janitor's Rooms.)—In every new tenement house, all rooms, except water closet compartments and bath rooms, shall be of the following minimum sizes: In each apartment there shall be at least one room containing not less than one hundred and twenty square feet of floor area, and every other room shall contain at least seventy square feet of floor area. Each room shall be in every part not less than eight feet six inches high from the finished floor to the finished ceiling, but an attic room need be eight feet six inches high in but one-half of its area; provided, that in a basement apartment used for janitor's use only, such room or rooms shall be not less than eight feet high in the clear.

Sec. 641. (Rooms.—Changes in Existing.)—No room in any now existing tenement house shall hereafter be constructed, altered, converted or occupied for living purposes unless it contains a window having a superficial area not less than one-twelfth the floor area of the room, which window shall open upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet; or unless such room adjoins another room in the same apartment, which other room shall have such a window opening upon such a street, alley, yard or court, and between which two adjoining rooms there shall be a sash window having at least fifteen square feet of glazed surface, the upper half of which shall be so made as to open easily.

Sec. 642. (Windows.—Courts.—Attic.)—No room in any now existing tenement house which has no such window, as aforesaid, opening upon a street or alley or upon a yard or court having a superficial area of not less than twenty-five square feet, shall hereafter be constructed, altered, converted or occupied for living purposes, unless it contains a floor area of at least sixty square feet and also at least six hundred cubic feet of air space; nor unless every part of the finished ceiling of such room be at least eight feet distant from every part of the finished floor thereof; provided, that an attic room need be eight feet high in but one-half of its area and such attic room shall not be used for purposes of human habitation other than as a sleeping room.

Sec. 643. (Air.—Quantity of for Each Person.)—No room in any tenement house shall be so occupied that the allowance of air to each person living or sleeping in such room shall at any time be less than four hundred cubic feet for each such person more than twelve years old, and two hundred cubic feet for each such person of the age of twelve years or under.

Sec. 644. (Alcoves.)—Every alcove shall be deemed a separate room for all purposes within the meaning of this chapter except such an alcove as, adjoining another room, has at least twenty per centum of entire wall surface of alcove opening to another room.

Sec. 645. (Light in Halls.—Recesses.—Returns.—Doors In.)—In every new tenement house every public hall shall be lighted by at least one window in each story opening directly upon a street, alley, yard or court, or by a skylight. Such window shall be so placed that light may pass directly through it and the hall to the opposite end of the hall, or else there shall be at least one window opening directly upon a street, alley, yard or court in every twenty feet in length or fraction thereof of every such hall, except in so much of any entrance hall as lies between the entrance and the flight of stairs nearest the entrance. In any such public hall, recesses or returns, the length of which do not exceed twice the width of the hall, will be permitted, without an additional window, but otherwise each recess or return shall be regarded for the purposes of this section as if it were a separate hall. Any part of a public hall which is shut off from any other part by a door or doors shall be deemed a separate public hall within the meaning of this section.

Sec. 646. (Public Halls.—Windows In.)—In every new tenement house one at least of the windows provided to light each public hall or part thereof shall have a glass area of at least twelve square feet.

Sec. 647. (Rooms and Halls.—Additional.)—Any additional room or hall that may hereafter be constructed or created in an existing tenement house shall comply in all respects with the provisions of this chapter as to size, arrangement, light and ventilation of rooms and halls.

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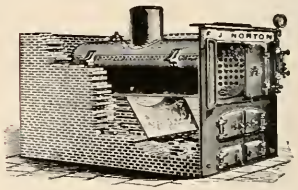

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Sec. 648. (Shafts.—Inner and Outer Vent.—Dimensions.)—Inner or outer vent shafts of all tenement houses as defined in Section 606 of this chapter shall be of the following dimensions:

Building.	Square Feet.	Least Width.
2 stories	22½	3 feet
3 stories	27	3 feet
4 stories	36	3 feet
5 stories	48	5 feet
6 stories	72	6 feet
7 stories	96	8 feet
8 stories	120	8 feet

Sec. 649. (Skylight Over Stairs.—Ventilating.—Area Of.)—In every new tenement house there shall be in the roof, directly over each stair well, a ventilating skylight, which shall have a glazed surface of the following dimensions: Where such tenement house shall not exceed two stories in height, and covering a superficial ground area of not to exceed sixteen hundred square feet, the glazed surface in such ventilating skylight shall be not less than fifteen square feet in area. For a three-story building, with a superficial ground area of not to exceed sixteen hundred square feet, the glazed surface of such ventilating skylight shall be not less than twenty square feet in area. For all buildings in excess of three stories and covering a superficial ground area in excess of 1,600 square feet, the glazed surface of such ventilating skylight shall be not less than twenty-five square feet in area; provided, however, that such ventilating skylights shall not be required in any of such buildings where the stairways are lighted by a window on each story landing.

If the building is more than three stories high, the skylights shall have at least six inches above same a strong wire netting (wire not lighter than No. 8 and a mesh not coarser than one and one-half by one and one-half inches) unless the glass contains a wire netting within itself.

Sec. 650. (Flues in Walls.)—In every new tenement house there shall be adequate flues in walls of masonry not less than forty-nine square inches area in each chimney running through every floor, with an open fireplace or grate or place for a stove, properly connected with one of such chimney flues, for every apartment, every additional flue used shall not be of less size than the above.

Sec. 651. (Cellar and Basement.—Ceilings.—Ventilation.)—All cellar and basement ceilings, unless the floor construction be fireproof, shall be plastered, and that part of the ceiling over the boiler or furnace extending two feet beyond in each direction shall be covered with metal lath and shall be plastered with cement, and every cellar shall be ventilated from both ends.

Sec. 652. (Damp-Proofing.—Basement Walls and Floors.)—Every new tenement house shall have all its outside walls below the adjacent ground level plastered on the outside with Portland cement or treated with other approved damp-proofing material, and such walls, as high as the ground level, shall be laid in cement mortar. The basement or cellar shall have a floor of Portland cement concrete not less than three inches in thickness.

Sec. 653. (Cellar Changed for Living Purposes.—Requirements.)—In no now existing or new tenement house shall any room in the cellar be constructed, altered, converted or occupied for living purposes; and no room in the basement of a tenement house shall be constructed, altered, converted or occupied for living purposes, unless all of the following conditions of this chapter be complied with, and at least one-third of the height of the basement shall be above grade for building; provided, in each case it shall be at least four feet above the street grade.

Sec. 654. (Cellar Rooms.—Height.)—Such rooms shall be at least 8 feet 6 inches high in all now existing or new tenement houses in every part, from floor to the ceiling, except as provided for janitor's use only in Section 640 of this chapter.

Sec. 655. (Water Closet.)—There shall be appurtenant to such room or apartment, a water closet conforming to the regulations and ordinances of the city relating to water closets.

Sec. 656. (Shafts, Areas, Etc., to Extend Two Inches Below the Floor.—Graded.—Concreted.—Drained.)—In every new tenement house, the bottom of all shafts, courts and yards which extend to the basement and light and ventilate the living rooms in such basement shall, by means of areas, not less than two feet six inches in their least dimension or otherwise, be extended a distance of at least two inches below the floor level of the part intended to be occupied. All shafts, inner courts and areas which extend to the ground shall be properly concreted, and all shafts, inner

and lot line courts and areas shall be properly graded and drained, and shall be so connected with a street sewer through an intermediate trap or surface basin (where such a sewer is adjacent to the lot), that all water may be drained freely into it.

Sec. 657. (Sinks.—Requirement.)—In every new tenement house there shall be in each apartment at least one proper sink with running water. In every now existing tenement house there shall be on every floor at least one proper sink with running water, accessible to all the tenants of that floor, without passing through any other apartment, if there be not one such sink in each apartment. In no tenement house shall there be woodwork inclosing sinks located in the public halls; the space underneath sinks shall be left entirely open.

Sec. 658. (Water Closets.—Access to.—Windows in.—Artificial Light.)—In every new tenement house there shall be a separate water closet in a separate compartment within each apartment, accessible to each apartment, without passing through any other apartment, provided that where there are apartments, consisting of only one or two rooms, there shall be at least one water closet for every two apartments. Every water closet compartment in every new tenement house shall have a window opening upon a street, alley, yard, court or vent shaft, and every water closet compartment in every existing tenement house shall be ventilated by such a window, or else by a proper ventilating pipe running through the roof. Every water closet compartment in every tenement house shall be provided with proper means of artificially lighting the same. If fixtures for gas or electricity are not provided in any such compartment, then the door thereof shall have ground glass or wire glass panels or transoms.

Sec. 659. (Sanitary Requirements.)—No drip trays shall be permitted in new tenement houses. All water closet fixtures in every new tenement house shall be constructed and set up conformably to the Requirements of the Department of Health. All privy vaults used in connection with any existing tenement house shall be replaced by water closets, constructed and set up in conformity with the provisions of this chapter, whenever connection with a public sewer is in any way practicable, and the Department of Health of the city shall be the sole judge as to the practicability of such connection with the public sewer. At least one such water closet shall be provided for every two apartments in each existing tenement house, and such water closets may be located in the yard if necessary. If so located, long hopper closets may be used, provided all traps, flush tanks and pipes be protected against frost.

Sec. 660. (Loads.—Allowances for Live Loads in Construction of Floors.)—For all buildings of Class VI. the floors shall be designed and constructed in such a manner as to be capable of bearing in all their parts, in addition to the weight of the floor construction, and including the weight of partitions and permanent fixtures and mechanisms that may be set upon the same, a live load of forty pounds for every square foot of surface in such floors.

Sec. 661. (Pipes Through Floors.)—In every new tenement house where plumbing or other pipes pass through floors or partitions, the openings around such pipes shall be sealed or made air tight with plaster or other incombustible material, so as to prevent the passage of air or the spread of fire from one floor to another or from room to room.

Sec. 662. (Catch Basins.)—The covers of all catch basins in lots containing tenement houses shall be of stone or iron, and shall be placed in courts or yards flush with the surface of such courts or yards, so that access to such basins may be convenient.

Sec. 663. (Stairways.—Fire Escapes to be Free From Incumbrance.)—No incumbrance of any kind shall at any time be placed before, upon or against any stairway, steps or landings or fire escapes in or upon any tenement house. All fire escapes upon tenement houses shall be kept in good order and repair, and every exposed part thereof shall at all times be protected against rust by durable paint.

Sec. 664. (Water Closets.—Access To.)—In every apartment of three or more rooms in every new tenement house convenient access from the outer door of the apartment to every living room and to every bedroom, and to every room used as a bedroom, and to at least one water closet compartment, shall be provided otherwise than through any bedroom or room used as a bedroom.

Sec. 665. (Buildings Damaged by Fire, Etc.)—If any existing tenement house is hereafter damaged by fire or other cause (including ordinary wear) so that at any time its value be less than one-half its original cost (exclusive of the value of the foundations) such building shall not be repaired or rebuilt except in conformity with the provisions of this chapter applicable to new tenement houses.

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Sec. 666. (Changes or Alterations.—Permits.)—Every new tenement house and all changes or alterations in any existing tenement house shall conform to the requirements of this chapter. No new tenement house shall be begun, nor shall any changes or alterations in any existing tenement house, such as are referred to in this chapter, be begun until a permit therefor shall have been issued by the Building Department of the city. Such permit shall be issued only upon an application by the person for whom the building is to be erected or altered, and after approval of the plans and specifications of such tenement house, or such changes or alterations by the Health Department of the city whenever such approval is required by law or ordinance.

Sec. 667. (Notice to be Sent to Commissioner of Buildings to Inspect.—Certificate to be Issued.—Notice to Inspect to be Filed.)—It shall be the duty of the owner or his agent, when a tenement house is in course of erection, to notify the Commissioner of Buildings of the city when the building is or will be ready for lathing, and the Commissioner shall, within three days of the time specified, cause an inspection to be made, and if the construction is found to be in accordance with the requirements of this chapter he shall issue or cause to be issued a certificate to that effect; otherwise he shall cause the penalties provided in Section 669 of this chapter to be enforced. The Commissioner shall file for reference the notice received and shall also file a copy of the certificate in the office of the Building Department.

Sec. 668. (Yards, Courts, Etc.—Must Comply as to.)—Any tenement house not conforming in itself and in its yards, courts, areas and shafts to the requirements of this chapter shall not be occupied, or if found occupied shall forthwith be vacated upon notice from the Commissioner of Buildings, and such tenement house shall not again be occupied until made to conform in all respects with the provisions of this chapter, notwithstanding the issuance of a building permit for the erection or alteration of such building.

Sec. 669. (Violations.—Penalty For.)—Any owner, lessee, tenant, occupant or agent of any tenement house, or any architect, contractor, builder or foreman superintending or in charge of the work of construction of any tenement house violating, disobeying, neglecting or refusing to comply with or resisting the enforcement of any of the provisions of this chapter shall be fined not less than ten dollars nor more than two hundred dollars for each offense, and any violation of any provision of this chapter, if continued after the first fine is imposed, shall, for every week of such continuance, be punishable by an additional fine of not less than ten dollars nor more than two hundred dollars.

Sec. 670. (Provisions of this Chapter not to Apply to Existing Buildings, Except Under Certain Conditions.)—Nothing in this chapter contained shall be considered as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this ordinance, and which at the time of their construction were built in compliance with the ordinances then in force, unless such building shall not have sufficient or adequate means of egress therefrom or ingress thereto by reason of insufficient or inadequate stairway or stairways improperly located or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

If, however, it is desired to enlarge or in any manner materially modify the construction of any existing building, or to make any change in its use or occupation which will transfer it from one class, as defined by this chapter, to another class, then before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, the entire building shall be reconstructed or modified in such manner as to bring the same, when enlarged or altered, or when occupied for its new and different purposes, into accordance with the provisions of this chapter.

Sec. 671. (Commissioner Shall Notify.)—Where it shall appear to the said Commissioner that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, he shall notify the owner, agent or person in possession, charge or control of such building, of such fact, and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to promote the safety of the occupants of such building and of persons using the same and of the public.

Sec. 672. (Where Conflicting with Other Sections.)—In cases of direct conflict with the provisions of other sections of this chapter relating to other classes, the provisions of the sections relating to Class VI. shall govern in respect to tenement houses.

666 to 672—442 to 448

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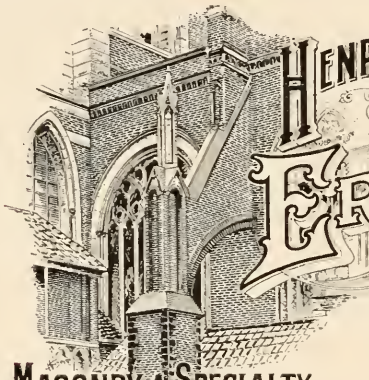

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ARTICLE X

PROVISIONS RELATING SOLELY TO CLASS VII.

Sec. 700. **(Class VII.)**—In Class VII. shall be included all buildings used for the sale at retail of dry goods and other articles of general merchandise and commonly known and described as "department stores."

Sec. 701. **(Buildings of Class VII.—Construction Of.)**—Buildings used either wholly or in part for the purposes of Class VII. three stories or less in height may be of ordinary construction.

Such buildings more than three and not exceeding five stories in height shall be of slow-burning, mill or fireproof construction.

Such buildings over five stories in height shall be of fireproof construction.

Sec. 702. **(Walls.—Thickness Of.)**—The thickness of inclosing walls shall conform to the following requirements:

		STORIES										
	Basement.	1	2	3	4	5	6	7	8	9	10	11	12
One-story	12	12											
Two-story	16	12	12										
Three-story	16	16	12	12									
Four-story	20	20	16	16	12								
Five-story	24	20	20	16	16	16							
Six-story	24	20	20	20	16	16	16						
Seven-story	24	20	20	20	20	16	16	16					
Eight-story	24	24	24	20	20	20	16	16	16				
Nine-story	28	24	24	24	20	20	20	16	16	16			
Ten-story	28	28	28	24	24	24	20	20	20	16	16		
Eleven-story	28	28	28	24	24	24	20	20	20	16	16	16	
Twelve-story	32	28	28	28	24	24	24	20	20	20	16	16	16

Provided, however, in buildings of steel skeleton, fireproof construction thickness of walls shall be governed by Section 911 of this chapter.

Walls, Ledges, Etc.—See Section 997.

Walls Around Stairs, Elevators and Shafts.—See Section 998.

Walls Reinforced (Concrete).—See Section 960.

Sec. 703. **(Stories Used for the Retail Sale of Goods.—Occupation of Basement.—Lockers.)**—Not more than the lower twelve stories above the street grade shall be used for the retail sale of goods, or for employes' locker rooms or for manufacuring purposes in a building devoted wholly or in part to purposes of Class VII., provided, however, the stories above the twelfth story may be used for these or other purposes when the stairs are built as described in Section 709 of this chapter.

Not more than one floor of any basement or cellar shall be used for the retail sale of goods. Such floor shall be the floor nearest to the inside street grade. Such floor used for the retail sale of goods shall not be more than twenty feet below the inside street grade.

No sub-basement, cellar or part of a basement below such floor shall be used for the sale of any goods in any manner, but locker and dressing rooms may be placed in the sub-basement, provided the space thus occupied be separated from the remainder of the basement by fireproof partitions, and that there be at least two flights of stairs placed as far apart as practicable leading therefrom to the first floor inclosed in fireproof partitions as provided in Sections 936, 937 and 938 of this chapter. Such stairs from such locker or dressing rooms shall be in addition to other stairways required by this chapter in such building, provided that at least one of such stairways shall open directly on a street, alley or court opening on a street or alley or a fireproof passage leading to the street, alley or such court. Where more than five lockers are in one room such lockers shall be of incombustible material.

Sec. 704. **(Floor Areas.—Maximum.)**—The floor area of any one story or portion of a story used for the purposes of Class VII. of any building of ordinary construction shall not exceed nine thousand square feet.

The floor area of any one story or portion of a story used for the purposes of Class VII. of any building of slow-burning or mill construction shall not exceed twelve thousand square feet.

The floor area of any one story or a portion of a story used for the purposes of Class VII. of any building of fireproof construction shall not exceed 25,000 square feet.

Sec. 705. **(Floor Areas.—Exceeding the Maximum Limits Defined in Section 704.)**—Where any floor or portion of a floor used for the purposes of Class VII. in any building shall exceed in area the maximum number of square feet allowed in the

preceding section for the type of construction of such building in which such floor is contained, each such maximum amount of floor area so used shall be separated from other parts of such floor by fire walls or dividing walls built in accordance with the provisions of Section 109 of this chapter relating to dividing walls in buildings of Class I.

Where any such floor so used is divided by such fire walls or dividing walls, each such division of such floor shall be provided with stairs, aisles, exits and fire escapes, as is required in this chapter for separate and distinct buildings, and each such division shall be considered as a separate building.

Sec. 706. (Galleries.)—The area of any one or all of the galleries, mezzanine or intermediate floors in any one story used wholly or in part for the purposes of Class VII. in any building shall not exceed 10 per centum of the area of such story, and galleries, mezzanine or intermediate floors of a larger size than the above shall be considered as full stories.

Every gallery, mezzanine or intermediate floor shall have at least one stairway not less than three feet wide.

The height from the floor of any gallery, mezzanine or intermediate floor to the ceiling over same shall not be less than seven feet, and there shall be not less than seven feet space between the bottom of such gallery, mezzanine or intermediate floor, and the floor of the story in which such gallery, mezzanine or intermediate floor is placed.

Every gallery, intermediate or mezzanine floor used for the purposes of Class VII. in any building shall be built entirely of fireproof or incombustible construction with the exception of the floor surface and nailing strips, which may be of wood.

No gallery, intermediate or mezzanine floor shall be built without a permit from the Department of Buildings, and plans showing the construction and size of such proposed gallery, intermediate or mezzanine floor shall be filed with the Department of Buildings when a permit is applied for.

Sec. 707. (Courts of Class VII. Buildings.)—Every court or light shaft of every building used wholly or in part for the purposes of Class VII. shall be open and unobstructed from the floor of such court to the sky, with the exception that fire escapes may be built therein, and such court shall have walls constructed in the same manner as is required for the exterior walls of such buildings; provided, that no walls inclosing such courts are required on street or alley lot lines.

All windows, doors or other openings in court walls of such buildings shall have metal frames, metal sashes and metal doors, with the glazed portion thereof of fire-resisting glass.

Sec. 708. (Stories.—Numbering Of.)—The first story above the inside street grade shall be designated and known as the first story for all purposes of this chapter, and the stories above shall be numbered, consecutively, the second, third, and so on.

Sec. 709. (Stairways.—Interior Stairways in Buildings of Class VII.)—Buildings used wholly or in part for purposes of Class VII. shall have two stairways if the aggregate floor area is five thousand square feet or less, three stairways if the aggregate floor area is more than five thousand square feet and not more than ten thousand square feet, and four stairways if the floor area is more than ten thousand square feet.

The number of stairways and the aggregate width of stairways required for the various floor areas shall be as indicated in the table hereinafter set forth in the following section.

The width of the different stairways need not be alike, and for each four stories, or fractional number of stories, of the building above the first four stories, each stairway may be reduced by six inches, as set forth in the table of stairs in Section 710, but no stair in a Class VII. building shall be of a less width than three feet.

Stairways in buildings used wholly or in part for the purposes of Class VII. shall be located as far apart as practicable, and shall have hand rails on each side thereof, and no such stairway shall be a spiral stairway or have any winders. The height of the individual riser shall not exceed seven and three-eighths inches. The width of the individual tread shall be not less than ten inches. Stairways which are over seven feet wide shall have double intermediate hand rails with end newel posts at least five and one-half feet high.

The bottom of each stairway shall be in the immediate vicinity of the top of the stairs leading to the next lower story, and the line of travel from stairway to stairway shall be direct and easily accessible each to the other.

Every story below street grade shall have not less than two stairways to the first story and each such stairway shall be not less than three feet wide, but where

a basement or cellar is used for the retail sale of goods the stairways from such basement or cellar shall be in number and aggregate width as indicated in the table of stairways set forth in the following section for the lower four stories of the same building.

The whole number of stairways required for any such building shall be complete in every respect from the first to the topmost floor, and each stairway shall be extended to the roof.

Sec. 710. TABLE OF STAIRWAYS FOR CLASS VII. BUILDINGS. AGGREGATE WIDTH OF STAIRWAYS.

	SQUARE FEET OF				
Building Area.	1st, 2d, 3d, 4th, Story or Stories.	5th, 6th, 7th, 8th, Story or Stories.	9th, 10th, 11th, 12th, Story or Stories.	13th, 14th, 15th, 16th. Story or Stories.	
25,000	30 feet	27 feet	24 feet	21 feet	6 stairways
20,000	25 feet	22 ft. 6 in.	20 feet	17 ft. 6 in.	5 stairways
15,000	20 feet	18 feet	16 feet	14 feet	4 stairways
14,000	19 feet	17 feet	15 feet	13 feet	4 stairways
13,000	18 feet	16 feet	14 feet	12 feet	4 stairways
12,000	17 feet	15 feet	13 feet	12 feet	4 stairways
11,000	16 feet	14 feet	12 feet	12 feet	4 stairways
10,000	15 feet	13 ft. 6 in.	12 feet	10 ft. 6 in.	3 stairways
9,000	14 feet	12 ft. 6 in.	11 feet	9 ft. 6 in.	3 stairways
8,000	13 feet	11 ft. 6 in.	10 feet	9 feet	3 stairways
7,000	12 feet	10 ft. 6 in.	9 feet	9 feet	3 stairways
6,000	11 feet	9 ft. 6 in.	9 feet	9 feet	3 stairways
5,000	10 feet	9 feet	8 feet	7 feet	2 stairways
4,000	9 feet	8 feet	7 feet	6 feet	2 stairways
3,000	8 feet	7 feet	6 feet	6 feet	2 stairways
2,000 and less	7 feet	6 feet	6 feet	6 feet	2 stairways

Sec. 711. **(Stairs.—Fireproof Interior.)**—Where an interior stairway and its stair hall of a building used wholly or in part for the purposes of Class VII. are inclosed in all stories of the building by fireproof partitions built as described in Section 936 of this chapter for fireproof construction, and where the stairways and landings are built as described in Section 938 of this chapter for fireproof construction, and where the doors, frames, sashes and casings and the glazed portions thereof are built as described in Section 927 of this chapter for fireproof construction, then such stairway, if not less than five feet in width from first floor to the topmost floor, shall be considered as the equivalent of two open stairways, but in no case shall there be less than two stairways in any such building.

Sec. 712. **(Stories.—Where Stories Above Twelfth Are Used for Class VII. Purposes.)**—Where stories above the twelfth story are used for the purposes of Class VII. as hereinbefore described for employes' locker rooms, then the stairways from the first to the topmost floor shall be built and inclosed as described in the preceding section, but the stairways shall be in number and in their aggregate width as required in the table of stairways set forth in Section 710 of this chapter.

Sec. 713. **(Stairs.—Halls.—Passageways and Aisles.—Signs and Lights.)**—The stair halls, passageways or stair aisles shall be unobstructed and shall be as wide as the stairs, and not less than four feet wide in any place in the clear.

The exit door or doors between floors and stair halls shall be as wide as the stairway to which they afford access, and for each elevator opening into such a stair hall the doors to floors shall be increased to two feet in width.

The stairways and stair halls of any building used wholly or in part for the purposes of Class VII. shall be illuminated by gas or electric light, and the gas piping and the electric wiring shall be accomplished by piping and circuits separated and distinct from the general illuminating piping and circuits of the premises. Each stair light shall have a red glass inclosure.

At the bottom of each such stairway there shall be an illuminating red glass sign with the number of the story in which it is situated inscribed thereon in letters not less than six inches high.

Sec. 714. **(Aisles in Class VII Buildings.)**—In buildings used wholly or in part for the purposes of Class VII. there shall be aisles in such portions of the building as are used for such purposes, connecting the stairway and the elevators directly with the street or alley doors, and such aisles shall be termed "main aisles." Such main aisles shall have a clear width equal to the width of the stairways connecting therewith, and for each elevator connecting with such an aisle there shall be an

additional width of six inches, and no such main aisle shall be less than five feet wide in the clear between the counters in any department store or between the fixed seats therein. One-third the width of any basement stairway shall be added to the width of the main aisle connecting with such stairway.

If there is a column in any such aisle, then the width of the aisle shall be increased by the width of such column.

If there is a counter or counters or settee, or any case or other obstruction, in an aisle, then that part of the aisle on each side of such counter, settee or case or other obstruction shall be considered as a separate aisle. No aisle other than a main aisle shall be less than three feet in width.

Sec. 715. **(Exit Signs and Lights.)**—All exits in buildings used wholly or in part for the purposes of Class VII. shall be clearly indicated by illuminated red signs with the word "EXIT" thereon in letters not less than six inches high. At the bottom of each stairway on the street level floor there shall be similar signs indicating the direction of the nearest exit to a street or alley.

Fire escape doors or windows shall be indicated by illuminated red signs with the words "FIRE ESCAPE" thereon in letters not less than six inches high.

Sec. 716. **(Doors at Street Level.—Revolving Doors.)**—The clear width of the exit openings shall be computed in the same manner as that provided for main aisles, and no door openings shall be less than five feet wide, and all doors shall swing outward. Revolving doors shall not be considered as exits.

Sec. 717. **(Doors in Dividing Walls.)**—Door openings may be built in dividing walls of such buildings, provided, however, that such door openings shall be provided with fireproof doors built as described in Section 110 of this chapter, and that each door shall have an efficient closing device, automatic in operation in the event of a fire, in close proximity to such door and on each side of such opening.

Each such opening shall have exit signs and lights as provided for street doors and exits in Section 715 of this chapter. There shall be aisles not less than five feet in width connecting with such doors from the main aisles, and in no case shall any such door be of less width than the aisle directly connecting therewith.

Doors and Windows.—When Required to Be Closed.—Fire Resisting Glass.—See Section 1049.

Sec. 718. **(Floors.—Strength Of.—Allowance for Live Loads.)**—Every structural part of every building used wholly or in part for the purposes of Class VII. shall safely support, in addition to the weight of floor construction, partitions and permanent mechanisms that may be set upon the same, a live load of not less than one hundred pounds per square foot of floor area, and the construction shall be calculated according to the safe unit stresses elsewhere defined in this chapter. Every part of any such building which is subjected to a live load of more than one hundred pounds per square foot of floor space shall be of sufficient strength in the parts which support such load to safely support the load imposed, calculated according to the safe allowable unit stresses elsewhere defined in this chapter.

Sec. 719. **(Fire Escapes in Class VII. Buildings.)**—Every such building more than two stories in height shall have two stairway fire escapes. Such stairway fire escapes shall each be not less than thirty-six inches wide between centers of hand rails. Such stairway fire escapes shall be at opposite ends of the building or as far apart from each other as practicable.

Sec. 720. **(Passageways.—Fireproof.)**—Where stairway fire escapes do not extend to the ground level they shall have a counterbalanced stairway to the ground from a platform not more than twenty feet above the ground level.

Fire escapes in inclosed courts shall have open, unobstructed fireproof passageways leading directly to a street or an alley.

Sec. 721. **(Fire Escapes.—Windows and Railings On.—Doors Opening On.)**—All windows and doors which are passed by a fire escape of any kind, and all windows and doors opening on fire escape platforms or landing shall have fireproof frames glazed with fire-resisting glass.

Each fire escape platform shall have at least one window on each floor in any such building opening thereon.

Each such window shall be indicated by signs and lights as required in Section 715 of this chapter for exits.

Where window sills at fire escape exits are more than two feet above the floor, one or more steps not less than three feet wide shall be provided, with risers not to exceed twelve inches high and treads not less than eight inches wide.

The railings on stairway fire escapes and the railings around fire escape platforms shall have iron guards in addition to the iron hand rails; such guards shall be not less than four feet high measuring from the outer corner of the tread

or from the platform; such guards shall have a mesh or openings not over two and one-half inches square, and the metal strands in such guards shall have a cross section of not less than one-eighth of an inch in diameter.

Sec. 722. **(Fire Drill of Employes.)**—It shall be the duty of every person or corporation maintaining or in possession, charge or control of any building used wholly or in part for the purposes of Class VII. to designate certain adult male employes in such building (the number of which employes shall be prescribed by the Fire Marshal), who shall be regularly and throughout the entire time such building is open to the public employed in such building, and who shall be physically and mentally able to perform the duties which shall be required of them in case of fire occurring in any such building. Such employes shall at least once in each month, when directed by the Fire Marshal or any authorized member of the Fire Department, take part in a fire drill conducted by the Fire Marshal, or any authorized member of the Fire Department, in the use of all apparatus for the prevention and extinguishing of fire in such building, whenever the Fire Marshal shall deem such drill necessary or advisable. Such person or corporation shall pay to the city the proportion of the regular salary of any employe of the Fire Department who shall be employed in drilling and examining the employes of any such building, based upon the time of such employment, and the Fire Marshal shall render bills monthly for such services.

Sec. 723. **(Standpipes.—Pumps.—Axes, Etc.)**—There shall be one or more standpipes on each floor of every such building, with hose connections and hose on reels or racks connected to same. Full water pressure in such standpipes shall be maintained during business hours. There shall be portable chemical or hand pumps and one or more Fire Department axes on each floor, all of which, in number and location, shall be placed or installed to the satisfaction of the Fire Marshal.

ARTICLE XI.

PROVISIONS RELATING SOLELY TO CLASS VIII.

Sec. 800. **(Class VIII.)**—In Class VIII. shall be included every building used exclusively for school purposes.

Sec. 801. **(Buildings of Class VIII.—Construction Of.)**—All buildings used wholly for the purposes of Class VIII. hereafter erected shall be constructed in accordance with the provisions of this ordinance relating to Class VIII. as follows, viz.:

Such buildings having a seating capacity of less than four hundred, or which are not over two stories and basement in height, may be built of ordinary construction.

Such buildings having a greater seating capacity than four hundred and less than eight hundred, or which are not over three stories and basement in height, shall be built of slow burning or fireproof construction.

Such buildings having a greater seating capacity than eight hundred, and which are more than three stories and basement in height, shall be built entirely of fireproof construction.

New additions to existing buildings may be built; provided, however, that such new additions shall comply with the above requirements.

All alterations in existing buildings used wholly for the purposes of Class VIII., other than new additions thereto, intended to make them comply with the requirements of this chapter, may be executed in the same materials of construction at present employed in such buildings, unless otherwise distinctly provided herein.

Sec. 802. **(Frame Buildings.—Portable.)**—Portable frame buildings used wholly for the purposes of Class VIII., not larger than twenty-eight feet by thirty-six feet, and not over one story high, may be erected, provided the exterior walls and roof of same are covered with metal or incombustible material, and the interior woodwork painted with fireproof paint, approved by the Commissioner of Buildings. And provided, further, that the location of such buildings shall be approved by the Commissioner of Buildings. Such portable buildings shall not be located nearer than ten feet to any other building, and shall not be maintained on any one lot or block for a longer period than two years after the date of the issuance of the permit therefor without a new permit from the Commissioner of Buildings.

Doors and Windows.—(When Required to Be Closed.—Fire-Resisting Glass.)—See Section 1049.

Sec. 803. **(Walls.—Window Openings In.)**—No wall of any building used wholly for the purposes of Class VIII. containing a window opening shall be nearer than five feet to any lot line of adjoining property (street and alley lines not included).

722-3—470-1 800-1—472 802-3—473-4

Sec. 804. **(Walls.—Thickness Of.)**—The following regulations shall govern the construction of buildings used wholly for the purposes of Class VIII.:

The thickness of surrounding walls and of all dividing walls carrying the load of floors or roof shall be as indicated in the following table, to-wit:

Walls Around Stairs, Elevators and Shafts.—See Section 998.

		——STORIES——				
	Basement.	1	2	3	4	5
	in.	in.	in.	in.	in.	in.
One story	16	12				
Two stories	16	16	12			
Three stories	16	16	16	12		
Four stories	20	20	16	16	12	
Five stories	24	20	20	16	16	16

Buildings built of fireproof construction shall be excepted from the foregoing provisions of this section, but shall comply with the other provisions of this chapter governing such buildings.

Sec. 805. **(Loads.—Live.)**—The floors of buildings used wholly for the purposes of Class VIII. shall be designed and constructed so as to be capable of bearing in all their parts, in addition to the weight of floor construction, partitions, permanent fixtures and mechanisms that may be set upon same, a live load of seventy-five pounds per square foot.

Sec. 806. **(Stories.—Height Of.)**—No story above the basement shall be less than twelve feet in height in the clear.

Sec. 807. **(Floor Levels in Buildings of Fireproof Construction.)**—The following limitations of floor levels of auditoriums or assembly halls of such buildings shall be observed in all cases:

In buildings of fireproof construction.

Not to exceed two thousand seating capacity, not over ten feet above sidewalk level.

Not to exceed one thousand seating capacity, not over thirty feet above sidewalk level.

Not to exceed eight hundred seating capacity, not over fifty feet above sidewalk level.

Not to exceed five hundred seating capacity, in any story; provided, however, that there shall be at least two separate and distinct stairways from the floor in which such auditorium or assembly hall is located to the ground, each of which shall not be less than four feet wide in the clear.

Sec. 808. **(Floor Levels.—In Buildings Having Stairs and Corridors of Fireproof Construction.)**

Not to exceed one thousand five hundred seating capacity, not over ten feet above sidewalk level.

Not to exceed one thousand seating capacity, not over twenty-five feet above sidewalk level.

Not to exceed eight hundred seating capacity, not over forty-two feet above sidewalk level.

Not to exceed five hundred seating capacity, not over fifty feet above sidewalk level.

Not to exceed two hundred and fifty seating capacity, not over sixty feet above sidewalk level.

Sec. 809. **(Floor Levels in Buildings of Mill, Slow-Burning or Ordinary Construction.)**

Not to exceed one thousand seating capacity, not over ten feet above sidewalk level.

Not to exceed six hundred and fifty seating capacity, not over thirty feet above sidewalk level.

Not to exceed five hundred seating capacity, not over forty-five feet above sidewalk level.

Not to exceed two hundred seating capacity, not over sixty feet above sidewalk level.

Sec. 810. **(Floors.—Height Of, Measured from Sidewalk Level.)**—Heights shall be measured from sidewalk level at entrance of buildings to highest part of main floor of auditorium or assembly hall.

Sec. 811. **(Stairways.—Width Of.)**—Stairways in buildings used wholly for the purposes of Class VIII. shall be in width equivalent to fifteen inches for every hundred of seating capacity in such building, as measured by the aggregate seating

capacity of the auditorium, assembly rooms and school rooms; provided, however, that the number of persons allowed in such buildings at any one time shall be limited by the width of stairways available as exits therefrom.

No stairway shall be less than four feet in the clear, except where more than two stairways lead down from any floor, in which case stairways three feet wide in the clear may be counted in the total width of stairways required.

Where two or more stairways are used, they shall be placed at opposite ends of the building, or as far apart as practicable, and all such buildings hereafter erected shall have at least two separate and distinct stairways from the ground floor to the top floor, and all existing buildings shall have two such separate and distinct stairways, or one stairway and one stair or sliding fire escape.

Sec. 812. **(Stairways.—Railings on Each Side.)**—All stairways shall have railings on each side thereof.

Sec. 813. **(Stairways.—Height of Landing.)**—No stairway shall ascend a greater height than thirteen feet six inches without a level landing, which, if its width is in the direction of the run of the stairs, shall be not less than four feet wide, or which, if at a turn of the stairs, shall be of not less width than the stairs, and no winder shall be permitted in any stairs.

Sec. 814. **(Stairways.—Fireproof.)**—In such buildings hereafter erected more than two stories and basement in height, the stairways and their enclosing wall shall be of fireproof construction.

Sec. 815. **(Corridors, Passageways, Hallways and Doors.—Width Of.)**—The width of corridors, passageways, hallways and doors shall be computed in the same manner as that herein provided for stairways; provided, however, that no corridor shall be anywhere less than five feet in width, and no door less than three feet in width, except where two or more doors, each two feet four inches or more in width, are grouped together.

Sec. 816. **(Doors to Open Outward.)**—All doors in such buildings shall open outward, and all entrance and exit doors shall be unlocked at all times when the building is occupied for school purposes, or open to the public.

Sec. 817. **(Doors.—Exits Covered with Metal.)**—All exit doors from assembly halls and class rooms to other parts of the building shall be covered with metal or other fireproof material, approved by the Commissioner of Buildings.

Sec. 818. **(Aisles.—Width Of.—Number of Seats in Auditorium.)**—Aisles in auditoriums and assembly halls in such buildings shall be in width equivalent to eighteen inches for every one hundred of seating capacity in such auditorium or assembly hall, but no such aisle shall be less than two feet six inches wide in its narrowest part. All groups of seats shall be so arranged that they shall have an aisle on each side, and not more than twelve seats in any one row shall be placed between aisles.

Sec. 819. **(Aisles in Class and Recitation Rooms.)**—Aisles in class rooms, recitation rooms and study rooms of such buildings shall be in width equivalent to eighteen inches for every one hundred permanent seats in any such room, but no main or cross aisle shall be less than two feet six inches wide in its narrowest part.

Sec. 820. **(Aisles and Passageways.—Kept Clear of Obstructions.)**—All aisles and passageways in such buildings hall be kept free from camp stools, chairs, sofas and other obstructions, and no person shall be allowed to stand in or occupy any of such aisles or passageways during any performance, service, exhibition, lecture, concert or any public assembly, nor shall there be any chairs, settees or camp stools in such aisles or corridors at such times or occasions.

Sec. 821. **(Emergency Exits for Auditoriums or Assembly Rooms.—Aggregate Width Of.)**—All auditoriums or assembly halls of such buildings having a seating capacity of eight hundred or more shall be provided with emergency exits. The aggregate width of such emergency exits which shall be provided for each floor, balcony or gallery of such auditorium or assembly hall shall be one-half of the width of the main exit. No emergency exit or stairway shall be less than three feet in width.

Sec. 822. **(Exits.—Signs.)**—All exits opening from auditoriums and assembly halls of such buildings shall have the word "EXIT," in letters at least six inches high, applied to the auditorium side of such exit, and when such auditorium or assembly hall is used at night, a red light shall be kept burning over the word "EXIT" during the entire time such building is so used and until the pupils or audience have left the building.

Sec. 823. **(Lights in Buildings.)**—Every portion of any such building devoted to the uses or accommodation of the public and all outlets therefrom leading to the

streets, including the open courts and corridors, stairways and exits, shall be well and properly lighted during the entire time such portion is in use, and shall remain lighted until all the pupils or the audience have left the premises. All gas or electric lights in the halls, corridors, lobbies, stairs and exits leading from the auditorium or assembly halls shall be controlled by a separate shut-off and shall be independent of all other lights in such building.

Sec. 824. (Windows.)—The total glass area of outside windows and skylights of each class room, recitation room or study room in such buildings shall be not less than one-ninth of the floor area of such room.

Sec. 825. (Basement.)—In every such building in which the lower or basement floor is below the surface of the ground surrounding such building, and is used in part or as a whole for heating or ventilating apparatus, such floor shall be considered the basement story of such building. Permanent class rooms in basements shall not be permitted.

Sec. 826. (Fire Escapes.)—Every building used for the purposes of Class VIII. of four or more stories in height shall be provided and equipped with one or more stairways or sliding fire escapes in such locations and numbers as shall be satisfactory to the Commissioner of Buildings.

Sec. 827. (Fire Escapes to Be Examined.)—It shall be the duty of the janitor of every such building, or such other employe or employes thereof as may be directed by the principal of such school to examine all fire escapes of such buildings from the topmost story to the ground, and to examine and operate all doors, windows and platforms leading to and from such fire escapes; and such inspection shall be made at least once each and every week that such building is used for school purposes, and a written report made of such inspection to the principal of such school, showing the time it was made and the condition of the fire escapes.

Such fire escapes shall be kept in good condition ready for immediate use at any and all times that such building is in use, and shall be kept free of snow and ice.

Sec. 828. (Fire Drill.)—The principal or other person in charge of the pupils in every such building shall establish and maintain a good and efficient fire drill, which shall be practiced at least twice every month during the time such building is used for school purposes.

A record shall be kept by the principal or other person in charge of the pupils of each fire drill held and of the time that elapses from the first fire signal until the last person is out of the building.

(Walls.—Around Stairs, Elevators and Shafts.)—See Section 998.

ARTICLE XII.

GENERAL PROVISIONS.

Fireproof Construction.

Sec. 900. (Fireproof Construction.)—In cases in which it is claimed that any equally good or more desirable mode or manner of construction, or material, or device for fireproofing, other than specified in this chapter, can be used in the erection or alteration of buildings, the Commissioner of Buildings, upon written application to him for a permit to use the same, shall have power to appoint a Board of Examiners, consisting of not less than three nor more than five members, each of whom shall have had at least ten years' experience in Chicago as an architect, engineer or builder, who shall take the usual oath of office. The said examiners shall adopt rules and specifications for examining and testing such mode or manner of construction, or material or device for fireproofing, and furnish a copy of the same to the applicant. And such specification shall provide for a comparative fire test of not less than four hours and for a period of at least two hours an average temperature of 2,000 degrees Fahrenheit shall be maintained. At the end of this test water shall be applied to the construction through a 1⅛-inch nozzle under 60 pounds pressure for five minutes. Hollow tile shall be used as a basis for comparison, and if the proposed material shall pass said test as well or better than hollow tile, it shall be approved as a fireproofing material. The said examiners shall thereupon notify such applicant to submit to such examination and make such tests in the presence of the said examiners, or a majority thereof, according to such rules and specifications. All expenses of such examiners, and of such examinations and tests, shall be paid by the applicant, and said examiners may require security therefor.

The said examiners shall, after such examination and tests, certify the results and their decision on the said application to the Commissioner of Buildings, who shall have power, in the event of the examination and tests being satisfactory,

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to grant a permit to the applicant in accordance with such decision of the said Board of Examiners.

A complete record of the proceedings and all acts and decisions of the said Board of Examiners shall be kept by the Commissioner of Buildings in his office.

The Commissioner of Buildings shall have the power to pass upon any question relative to the mode or manner of construction or materials to be used for fireproofing in the erection or alteration of any building or structure to make the same conform to the true intent and meaning of the several provisions of this chapter.

Sec. 901. **(Fireproof Construction.—Definition Of.)**—The term fireproof construction shall apply to all buildings in which all parts that carry weights or resist strains, and also all exterior walls and all interior walls and all interior partitions and all stairways and all elevator enclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by coverings of a material which shall be entirely incombustible, and a slow heat conductor, and hereinafter termed "fireproof material." Reinforced concrete as defined in this ordinance shall be considered fireproof construction.

Sec. 902. **(Fireproof Material.)**—The materials which shall be considered as filling the conditions of fireproof covering are: First, burnt brick; second, tiles of burnt clay; third, approved cement concrete; fourth, terra cotta; fifth, approved cinder concrete.

Sec. 903. **(Concrete.—Approved Cement.)**—All approved cement concrete shall consist of a standard Portland cement, torpedo sand and crushed stone or gravel, or crushed blast furnace slag, or crushed burnt clay, the volumetric quantity of any one of these materials combined with the torpedo sand shall not exceed nine times the volume of the Portland cement. All of the ingredients of cement concrete shall be thoroughly worked and wet so as to cover each piece of stone or gravel or slag or burnt clay with moistened cement; and the cement and sand shall fill the voids between the coarse material of the cement concrete.

Cement concrete to be considered a fireproof material shall be cast and rammed in an unset condition against the metal.

Sec. 904. **(Machine or Hand Pressed Concrete.)**—Machine or hand pressed concrete bricks or blocks are not considered in this chapter as a fireproof material for the protection of metallic structural members.

Sec. 905. **(Brick, Burnt Clay, Tiles, Etc.—How Applied.)**—Brick, burnt clay, hollow tiles, porous clay, solid tiles and terra cotta shall be applied to the metal in a bed of mortar.

Sec. 906. **(Fireproof Covering.—Minimum Thickness Of.)**—The minimum thickness of fireproof covering on any metal shall be, if of hollow tile, constructed in such a manner that there shall be not less than one air space of at least three-fourths of an inch, by the width of the metal surface to be covered, within the clay covering; if of porous clay tiles, the covering shall be at least one and one-half inches thick. The minimum thickness of concrete covering any metal shall be two inches.

Sec. 907. **(Incombustible Materials.)**—A metal or fire-resisting glass of not less than one-quarter inch in thickness, or plastering, or plaster blocks, or stone or granite, or marble, or an improved cinder concrete, or one of the fireproof materials described herein shall be considered an incombustible material as called for by this ordinance.

Sec. 908.—**(Concrete.—Cinder.—Floor Filling.—Specifications For.)**—Whenever the use of a cinder concrete is permitted by this chapter, such cinder concrete shall be composed of the following named ingredients, in the proportion here described, to-wit: Five parts of clean, thoroughly burnt steam boiler cinders, no particle of which shall be larger than one (1) inch; three parts of clean grit sand, or of clean stone screenings, and one part of a Standard Portland cement; the working and wetting of these ingredients shall be done in the same manner as required for cement concrete in Section 903 of this chapter, and such a mixture of approved cinder concrete may be used only for floor filling.

Sec. 909. **(Fireproof Covering.—Measurements.)**—In every case the thickness of the covering specified in this chapter shall be measured from the extreme projection of the metal, unless otherwise provided herein.

Sec. 910. **(Skeleton Construction.)**—The term "skeleton construction" shall apply to all buildings wherein all external and internal loads and strains are transmitted from the top of the building to the foundations by a skeleton or framework of metal. In such metal framework the beams and girders shall be riveted to each other at their respective junction points. If columns made of rolled iron or steel are used, their different parts shall be riveted to each other, and the beams and gird-

ers resting upon them shall have riveted connections to unite them with the columns. If cast iron columns are used, each successive column shall be bolted to the one below it by at least four bolts not less than three-fourths of an inch in diameter, and the beams and girders shall be bolted to the columns. At each line of floor or roof beams, lateral connections between the ends of the beams and girders shall be made in such manner as to rigidly connect the beams and girders with each other in the direction of their length.

Sec. 911. **(Walls.—Enclosing.)**—If buildings are made fireproof entirely, and have skeleton construction so designed that their enclosing walls do not carry the weight of floors or roof, then their walls shall be not less than twelve inches in thickness; provided, such walls shall be thoroughly anchored to the iron skeleton, and whenever the weight of such walls rests upon beams or columns, such beams or columns shall be made strong enough in each story to carry the weight of wall resting upon them without reliance upon the walls below them. All walls shall be of fireproof or incombustible material.

Sec. 912. **(Columns.—Exterior.)**—All iron or steel used as a vertical supporting member of the external construction of any building exceeding sixty feet in height shall be protected as against the effects of external changes of temperature, and of fire, by a covering of fireproof material consisting of at least four inches of brick, or of four inches of concrete, or of four inches of burnt clay tiles, or of four inches of hollow terra cotta, or of a combination of any two of these materials, provided that their combined thickness is not less than four inches. The thickness of four inches shall be measured from the extreme projections of the metal of the column proper.

Where stone or other incombustible material is used for the exterior facing of a building, the distance between the back of the facing and the extreme projections of the metal of the column proper shall be at least four inches, and this four-inch space shall be filled with one of the "fireproof materials."

In all cases, the brick or burnt clay, tile or terra cotta, if used as a fireproof covering, shall be bedded in cement mortar close up to the iron or steel members, and all joints shall be made full and solid.

Sec. 913. **(Fireproofing of Exterior Sides of Mullions.)**—In buildings required by this chapter to be of fireproof construction, all vertical door or window mullions over eight inches wide shall be faced with incombustible material; horizontal transom bars over six inches wide shall be faced with a fireproof or with an incombustible material.

Sec. 914. **(Spandril Beams, Girders, Lintel.)**—The metal of the spandril beams or spandril girders, or lintels of exterior walls, which support a part of exterior walls, shall be covered in the same manner, and with the same material, as specified for the exterior columns in this chapter. The covering thickness shall be measured from the extreme projection of the metal in every case.

Sec. 915. **(Fireproof Covering Independent.)**—All covering of brick, concrete, burnt clay tiles, hollow terra cotta or of a combination of any two of these materials shall be applied to all of the structural members of the exterior of a fireproof building previously and independently of the application of the architectural facing of such a fireproof building with an incombustible or fireproof material.

Sec. 916. **(Iron or Steel Plates for Support of Wall.)**—If iron or steel plates or angles are used in each story for the support of the facings of the walls within such story, such plates or angles shall be of sufficient strength to carry the weight within the limits of fiber stress for iron and steel elsewhere specified in this chapter, the enveloping material for such story, and such plates or angles may extend to within two inches of the exterior of such covering.

Sec. 917. **(Walls, Support and Fireproofing Of.)**—Where skeleton construction is used for the whole or part of a building, the enveloping material and the walls shall be independently supported on the skeleton frame for each individual story.

Sec. 918. **(Terra Cotta.)**—If terra cotta or other hollow blocks are used, as fireproof covering, they shall be backed up with brick or hollow tile or concrete; whichever is used shall be, however, of such dimensions and laid up in such a manner that the backing will be built into the cavities of the facing so as to secure perfect bond between the facing and its backing.

Sec. 919. **(Coping.)**—The upper surfaces of all breaks or offsets in external coverings and fillings and walls, as well as the tops of walls, shall be covered with stone, terra cotta, metal, concrete or fire clay copings set in cement mortar. Copings of all kinds which do not have lapped joints shall be pointed with mortar composed of one part of standard Portland cement and two parts of torpedo sand.

Sec. 920. **(Columns.—Interior.)**—The covering of interior columns shall be one or more of the fireproof materials herein described.

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If such covering shall be of brick or concrete it shall be not less than four inches thick; if of burnt clay tiles such covering shall be in two consecutive layers, each not less than two and one-half inches thick, with one air space; if of porous clay solid tiles it shall consist of at least two layers not less than two inches thick each, or if constructed of a combination of any two of these materials, one-half of the total thickness required for each of the materials shall be applied, of each of such materials. Whether hollow tile, porous tile or terra cotta is used, the two consecutive layers shall be so applied that neither the vertical nor the horizontal joints in the same shall be opposite each other, and each course shall be so anchored and bonded within itself as to form an independent and stable structure.

In all cases, the brick or hollow tile, solid tiles or terra cotta shall be bedded in cement mortar close up to the iron or steel member, and all joints shall be made full and solid.

In the case of columns having an "H" shaped cross section or of columns having any other cross section, with channels or chases open from base plates to cap plates on one or more sides of the columns, then the thickness of the fireproof covering may be reduced to three inches, measuring in the direction in which the flange or flanges project, and provided that the thin edge in the projecting flange or arms of the cross sections does not exceed three-quarters of an inch in thickness. The thickness of the fireproof covering on all surfaces measuring more than three-quarters of an inch wide and measuring in a direction perpendicular to such surfaces shall be not less than that specified for interior columns in the beginning of this section, and all spaces, including channels or chases between the fireproof covering and the metal of the column, shall be filled with a solid fireproof material. Lattice or other open columns shall be completely filled with approved cement concrete.

Sec. 921. **(Foundations.—Steel In.—Concrete Around Bottom of Columns.)**—If steel or iron in any form is used as part of a foundation, it shall be thoroughly imbedded in a concrete, the ingredients of which shall be such that, after proper ramming, the interior of the mass will be free from cavities. The steel or iron shall be entirely enveloped in approved cement concrete, and around the exposed external metal surfaces of such foundation there shall be a covering of approved cement concrete not less than four inches thick.

After the base or base plates and columns have been set in place, both shall be protected from the effects of moisture by a covering of approved cement concrete applied direct to the metal in an unset state, measuring not less than two and one-half inches thick from the extreme projection of the metal, filled solid into all spaces, and forming a continuous concrete mass from the grillage or other foundations to an elevation six feet above the floor level nearest the column base plate or column stool.

Sec. 922. **(Columns.—Wiring Clay Tiles On.)**—Burnt clay tile column covering shall be secured by winding wire around the columns after the tile has all been set around such columns. The wire shall be securely wound around the tile in such manner that every tile is crossed at least once by a wire. If iron wire is used it shall be galvanized, and no wire used shall be less than No. 12 gauge.

Sec. 923. **(Fireproofing.—Protective Covering For.)**—In places where there is trucking or wheeling or other handling of packages of any kind, the lower five feet of the fireproofing of such columns shall be encased in a protective covering either of iron or oak plank, which covering shall be kept continually in good repair.

Sec. 924. **(Pipes Inclosed by Covering.)**—Pipes shall not be inclosed in the fireproofing of columns or in the fireproofing of other structural members of any fireproof building, provided, however, gas or electric light conduits not exceeding one inch inside diameter may be inserted in the outer two inches of the fireproof of such structural member.

Sec. 925. **(Shafts, Etc.)**—In cases where a pipe, conduit, dumb waiter, cable, wire, conveyor, belt or any combination thereof passes from one story to another story through an open hatch or floor opening, a shaft or enclosure of fireproof material shall be built from floor to floor around such hatch or floor opening, in each story above and below such hatch or floor opening in the same manner as described for fireproof partitions in this chapter. The area of space thus inclosed shall not exceed the area of the hatch or floor opening by more than one hundred per centum.

In no case shall any wood be used in the construction or support or fittings of such shaft as described above. If such holes in floors as described above in this section are not enclosed by such fireproof enclosures, then the open spaces in each floor opening not occupied by pipes, conduits, cables, wires, conveyors, belts or any combination thereof, shall be filled solid with fireproof material not less than eight inches thick.

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Sec. 926. (Shafts, Partitions Around, Plastering Of.)—All burnt clay or terra cotta partitions or walls around shafts having openings in floors shall be plastered on the outside and plastered or pointed on the inside.

Sec. 927. (Shaft, Doors and Windows.)—All doors, frames, sashes, casings and windows in partitions or walls around floor openings, or around stair shafts or elevator shafts, shall be built of incombustible material. The supports of such doors, frames, sashes, casings and windows shall also be of incombustible material; in the case of doors, such supports shall be of rolled structural metal extending from floor to ceiling and secured to both. Where there are brick walls of twelve inches or more in thickness the supports need not extend to ceiling as above specified. All glass used in connection with such partitions or walls shall be fire resisting.

Sheet metal work pressed over asbestos paper and wood may be used for the doors, frames, sashes and casings, and for openings in such partitions, except for elevator doors in shafts and where the provisions of this chapter require all metal doors.

Sec. 928. (Beams and Girders, Coverings Of.)—The beams and girders of the interior structural parts of a building shall be covered by one of the fireproof materials, so applied as to be supported entirely by the beam or girder protected, and shall be held in place by the support of the flanges of such beams or girders and by the cement mortar used in setting. If metal binding or metal anchors are used as fastenings of such fireproof covering, such metal binding or such metal anchor shall be protected by not less than one-half inch of fireproof covering.

If the covering is of brick it shall be not less than four inches thick; if of hollow tiles or if of solid porous tiles, or if of terra cotta, each of such tiles shall be not less than one and one-half inches thick, applied to the metal in a bed of cement mortar; hollow tiles shall be constructed in such a manner that there shall be one air space of at least three-fourths of an inch by the width of the metal surface to be covered within such clay coverings; the minimum thickness of concrete on the bottom and sides of metal shall be two inches.

The top of all girders and beams shall be protected with two inches of brick or one and one-fourth inches of burnt clay, or two inches of approved cement concrete, or three inches of approved cinder concrete. The brick or burnt clay shall be bedded solid on the metal in cement mortar.

In all cases of beams or girders, in roofs or floors, no matter what the material or form of the floor arch used, the protection of the bottom flanges of the beams and girders and so much of the web of the same as is not covered by the arches shall be made as hereinbefore specified for the covering of beams and girders. In every case the thickness of the covering shall be measured from the extreme projection of the metal, and the entire space or spaces between the covering and the metal shall be filled solid with one of the fireproof materials excepting the air spaces in hollow tile.

Sec. 929. (Girders and Trusses.)—All girders or trusses, when supporting loads from more than one story, shall be fireproofed with two thicknesses of fireproof material or a combination of two fireproof materials, as required for exterior columns in Section 912 of this chapter, and each covering of fireproof material shall be bedded solid in cement mortar.

All other girders or trusses supporting only a ceiling or roof shall be covered with a fireproof covering as specified for beams and girders in Section 928 of this chapter.

Sec. 930. (Cut-Out Boxes, Chases, Etc.)—No electric service cut-out box, switch box, cabinet, chase or any other recess, shall encroach on the minimum thickness required for any fireproof covering on structural metal, except as provided in Section 924 of this chapter. If the depth of any cut-out box, switch box, cabinet, or chase, or of any other recess, is to be concealed or partially concealed, then the thickness of the fireproof covering shall be increased correspondingly.

Sec. 931. (Floor, Construction Of.)—Brick, hollow tile, porous terra cotta, or approved cement concrete, or approved cinder concrete, shall be used for the construction of floors and roofs of fireproof buildings. Flat arch hollow tile, or flat arch porous clay tile floor arches shall have a height of at least one and one-half inch for each foot of span.

Sec. 932. (Hollow Tile Flooring.)—Hollow tile flat arch floor construction having a thickness of only one and one-half inch for each foot of span shall be used only for the minimum floor loads, and the area of burnt clay in the flanges and ribs and webs of the hollow burnt clay tiles shall be proportioned to the safe value of resistance to compression of the materials used, in the most stressed areas of the burnt clay.

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Sec. 933. **(Segmental Arches.)**—Segmental arches shall have a rise of at least one inch for each foot of span of arch.

The least thickness of a hollow tile or porous terra cotta segmental arch shall be one-half of an inch per foot of span, but on such hollow tile or terra cotta arch shall be of a thickness less than five inches.

Both flat and segmental arches shall be so constructed that the joints of the same radiate from a common center and there shall be a cross rib for every four inches, or fractional part thereof, in height in each tile block. The skew back of the arches shall be carefully fitted to the beams supporting them, and in addition to the cross ribs there shall also be additional diagonal reinforcing ribs in the skew back. Such arches, whether flat or curved, shall have their beds well filled with cement mortar, and the centers shall not be struck until the mortar has set.

Burnt clay skew backs shall be molded in such a manner as to support the burnt clay covering on the under sides of beams or girders.

Sec. 934. **(Floors, Wood Surfacing and Nailing Strips.)**—Wood floor surfacing and wooden nailing strips for such wood floor surfacing may be used in fireproof buildings.

Where wood flooring is used in a fireproof building, the space immediately under such wood flooring, and between the wood nailing strips and under such wood nailing strips, shall be filled with a cement or a cinder concrete tamped into place in an unset state, or such other incombustible material as shall be approved by the Commissioner of Buildings.

Sec. 935. **(Partitions in Fireproof Buildings.)**—The partitions around stairs, stair halls, shafts, elevators or public lavatories shall be fireproof partitions, as described in Section 936 of this chapter; all other partitions in fireproof buildings shall be incombustible partitions. Where blocks are used for building partitions or as enclosing walls the joints shall be well filled with mortar.

The partitions shall be wedged tight between floors and ceilings with incombustible wedges.

Sec. 936. **(Partitions, Fireproof.)**—Only fireproof material shall be used for fireproof partitions; if of brick, they shall be not less than four inches thick, and if of partition blocks, not less than three inches thick. If fireproof partitions are of reinforced concrete they shall be not less than two inches thick.

All fireproof partitions shall be supported directly by the steel construction, or by the fireproof floor arches, or stone concrete, or brick. No cinder concrete or wood flooring shall intervene between any such partition and its support.

All doors, windows, sashes, frames, casings and glass in fireproof partitions shall be built as required in Section 927 of this chapter.

Sec. 937. **(Partitions, Incombustible.)**—Only fireproof or incombustible material shall be used in the construction of incombustible partitions, excepting that frames, casings, doors, sash and the rough carpenter work required for the proper fastenings of such frames, casings, doors or sash, may be of wood, and that ordinary glass may be used in doors and partition windows.

Sec. 938. **(Stairs, Landings.)**—Stairs in fireproof buildings shall be built of approved cement concrete, reinforced concrete, stone or with metal supports, metal strings, metal treads, metal platforms, or a combination of one or more of such materials.

If reinforced concrete is used in the construction of any stairs in a fireproof building, such stairs shall be designed according to the provisions of the sections applying to reinforced concrete.

Stairs shall carry a live load of not less than one hundred pounds per square foot on treads and landings, and every part of a stair shall be so designed that the safe limit of fiber stress is not exceeded.

The hand rails of such stairways may be of wood, all other material in such stairways in fireproof buildings shall be "fireproofed," or "incombustible" material, except cinder concrete.

If stairs are constructed of solid concrete, having the tread and riser in one piece, then there shall be not less than forty-five square inches of concrete in the cross section of such combined tread and riser, and such stairs shall have reinforced concrete or metal outer strings.

If stone treads or platforms are used they shall have a metal sub-tread, or sub-platform, of the same weight as if the metal alone were used.

If platforms have a floor arch sub-construction as described in Section 931 of this chapter, then the metal sub-platform may be omitted.

Sec. 939. **(Painting.)**—All structural metal which is used in a fireproof building, or which is used in any foundation, or which is used in reinforced concrete work,

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shall be clean and free of rust, or scale at the time of the enclosure or covering of such metal. All metal which is not to be fireproofed shall have two coats of first-class metal protecting paint.

Sec. 940. **(Rivets, Machine Driven.)**—All structural steel and iron work shall be so riveted that the distance from the center of the rivet hole to the edge of the materials shall be not less than:

⅝ inch for ½-inch rivets.
⅞ inch for ⅝-inch rivets.
1⅛ inches for ¾-inch rivets.
1⅜ inches for ⅞-inch rivets.

Wherever possible, however, the distance from the rivet hole to the edge of the material shall be equal to two diameters of such rivet hole. All rivets, wherever practicable, shall be machine driven; the rivets in connection shall be proportioned and placed to suit the stresses, and the pitch of rivets shall never be less than three diameters of the rivets nor more than six inches. All holes shall be punched accurately, so that upon assembling a cold rivet will enter the hole without straining the material by drifting. The rivets shall fill the holes completely, and, whenever necessary, gussets shall be provided of thickness and size to accommodate the number of rivets necessary to make a connection.

Sec. 941. **(Truss Designs to Be Submitted.)**—When steel or iron trusses are used the trusses shall be of such design that the stress in each member may be calculated and all trusses when placed shall be held rigidly in position by an efficient system of lateral and sway bracing, and any member of a truss subjected to transverse stress in addition to direct tension or compression shall have the stress causing such strain added to the direct stresses coming on the member, and the total stresses shall in no case exceed the stresses provided for in Section 1004 of this chapter.

Sec. 942. **(Trusses to Be Inspected.)**—On all buildings in process of construction, where the plans call for the use of trusses, or iron and steel structural work, the erection of such iron and steel structural work and of such trusses shall be inspected thoroughly by an inspector from the Building Department of the city, and such inspector shall be a man well versed in the design and construction of structural steel and iron work, and it shall be the duty of such inspector to see that the provisions of this chapter are strictly complied with, and such inspector shall have the authority to compel the contractors and builders to use a sufficient amount of temporary bracing or guys necessary to insure the safety of the work during its erection and to compel such contractors and builders to keep all derricks, tackles and hoisting appliances used in such work in a safe condition and to enforce all the provisions of this chapter.

Sec. 943. **(Bolts to Be Turned and Holes to Be Reamed.)**—Wherever it is found impossible to rivet connections as herein described and such connections are bolted, the bolts shall be turned and the holes reamed so as to get a perfect fit.

All structural members which are temporarily bolted together shall be well bolted in every alternate hole.

Sec. 944. **(Fireproof Buildings, Height Of.)**—The height of a fireproof building shall be measured from the average inside grade line of the street frontage of the building to the top of the highest point of the external bearing walls. Roof houses for elevators, or tanks, or skylights, or stairs, or scuttles may be built above the height of the main roof, and no building shall be erected in the city of greater height than two hundred and sixty feet.

Sec. 945. **(Roofs, Rise of Roof Above Limit of Height.)**—In the case of buildings which are entirely fireproof in their construction, and of which the roof is also entirely of fireproof construction, the roof may rise above the limit of height of wall fixed by this chapter for such buildings at a slope not to exceed thirty degrees with the horizon, and to a height not exceeding twenty feet above such limitation of the height of such wall. The space enclosed by such roof above the limitation of the height of such wall may be used as an enclosure for pipes, ventilating or elevator machinery or for ventilating ducts, but it shall not be lawful to use such space for purposes of storage, business or residence.

Sec. 946. **(Sheet Metal Work, Support Of.)**—Wood shall not be used as the support of any sheet metal work or of any gutter or cornice of a building more than one hundred feet in height.

Sec. 947. **(Reinforced Concrete.—Regulations in Regard to the Use Of.)**—The term "reinforced concrete," as used in this ordinance, shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

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Sec. 948. **(Stress.)**—Reinforced concrete construction shall be of such nature that the stresses can be calculated according to the accepted formulas of modern concrete engineering practice.

Sec. 949. **(Permission to Erect.)**—Before permission to erect any reinforced concrete structure is issued, complete drawings and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

Sec. 950. **(Concrete.—Mixing Of.—Method of Testing.)**—The concrete shall be mixed in the proportion of one of cement, three of sand and five of stone, gravel or slag. The proportions shall be such that the resistance of the concrete to crushing shall not be less than two thousand pounds per square inch after hardening for twenty-eight days. The tests to determine this value shall be made by a competent engineer under the direction of the Commissioner of Buildings. The concrete used in reinforced concrete construction shall be what is usually known as a wet mixture.

Sec. 951. **(Cements.—Method of Testing.)**—Only high-grade Portland cements shall be used in reinforced concrete construction. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least two hundred pounds per square inch; and after one day in air and six days in water shall develop a tensile strength of at least five hundred pounds per square inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at least six hundred pounds per square inch. Other tests as to fineness, constancy of volume, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers' Committee, may from time to time be prescribed by the Commissioner of Buildings.

Sec. 952. **(Sand.—Torpedo.)**—The sand to be used in such concrete shall be clean, sharp torpedo sand, free from loam or dirt.

Sec. 953. **(Stone, Crushed Slag or Gravel.)**—The stone used in such concrete shall be clean, crushed stone or gravel, or crushed blast furnace slag of a size that will pass through a three-quarter-inch ring., The stone shall be fresh broken and the gravel shall be thoroughly washed.

Sec. 954. **(Steel.)**—The steel used shall be calculated according to its elastic limit; for moving or vibrating loads a steel of a lower elastic limit than is used for quiescent loads shall be used.

Sec. 955. **(Reinforcing.—Method Of.)**—All reinforcing steel shall be completely enclosed by the concrete, and such steel shall nowhere be nearer to the surface of the concrete than the diameter of such reinforcing steel bar, or rod or other shape. The steel in beams or girders shall be so disposed that there shall be not less than one and one-half times the thickness of the steel in concrete between the steel, and where more than two bars are used the bars shall be placed in two or more planes. Reinforced concrete shall be so designed that the stresses in the concrete and the steel shall not exceed the following limits: Extreme fiber stress on concrete in compression, five hundred pounds per square inch; shearing stress in concrete, seventy-five pounds per square inch; concrete in direct compression, three hundred and fifty pounds per square inch; tensile stress in steel, one-third of the elastic limit; shearing stress in steel, ten thousand pounds per square inch.

The adhesion of concrete to steel shall be assumed to be seventy-five pounds per square inch of surface where bars are three-quarters of an inch or less in diameter and proportionately less for bars of a diameter greater than three-quarters of an inch.

The ratio of the moduli of elasticity of concrete and steel shall be taken as one to twelve.

The following assumption shall guide in the determination of the bending moments due to external forces: Beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than W. L. divided by eight; the bending moment may be taken at W. L. divided by twenty in the case of square floor plates which are reinforced in both directions and supported on all sides. The floor plate to the extent of not more than five times the width of any beam or girder may be taken as part of that beam or girder in computing its moment of resistance.

The moment of resistance of any reinforced concrete construction under transverse loads shall be determined by formulas based on the following assumptions:

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(a) The bond between the concrete and steel is sufficient to make the two materials act together as a homogeneous solid.

(b) The strain in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

(c) The modulus of elasticity of the concrete remains constant within the limits of the working stresses fixed in this chapter.

From these assumptions it follows that the stress in any fiber is directly proportionate to the distance of that fiber from the neutral axis.

The tensile strength of the concrete shall not be considered.

Sec. 956. **(Construction.—Reinforced Concrete.)**—Reinforced concrete construction shall be designed so that the shearing stresses, both vertical and horizontal, developed in any part of the construction, shall not exceed the safe working strength of the concrete as fixed in this chapter, or a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to sheer is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded, some provision shall be made for transmitting the strength of the steel to the concrete.

Sec. 957. **(Columns.—Reinforced Concrete.)**—Reinforced concrete may be used for columns when the ratio of length to the least side or diameter does not exceed twelve. The reinforcing rods shall be tied together at intervals of not more than the least side or diameter of the column, or spirally wound steel may be used.

When vertical reinforcing rods are used in columns, such rods shall have their ends milled normal to the longitudinal axis, and such rods shall have full perfect bearings at each joint, and such joints shall occur only at floors or other points lateral support and a tight fitting sleeve shall be provided at all joints of vertical reinforcing rods.

Sec. 958. **(Wind Pressure.)**—In the case of buildings in which allowances must be made for wind pressure as provided in Section 1013 of this chapter, the reinforcing rods of columns shall be connected and the milled end surfaces shall be brought together by threading the rods and by threaded sleeve nuts, or threaded turnbuckles, or methods equally effective and satisfactory to the Commissioner of Buildings.

Sec. 959. **(Tests.—To Be Made by Contractor on Demand.)**—The contractor shall be prepared to make load tests on any portion of a reinforced concrete construction within a reasonable time after erection, as often as may be required by the Commissioner of Buildings. Such tests shall show that the construction will sustain a load twice that for which it is designed, without any sign of failure, or in the case of beams, girders or floors, without deflecting more than one-seven-hundredths of the span.

Sec. 960. **(Reinforced Concrete Walls.)**—Buildings of Classes I., II., III., VI. and VII. having a complete skeleton construction of steel or of reinforced concrete construction or a combination of both, designed to safely resist all of the strains caused by the dead weights of the structure and of the live loads and of the wind pressure within the safe limits of stress provided in this chapter for each material used, may have walls of reinforced concrete six inches thick for the upper two stories and walls seven inches thick for the two stories next below the upper two stories, and walls eight inches thick for the stories next below the upper four stories, and walls nine inches thick for the stories next below the upper six stories, and so on downwards, increasing the thickness of the walls one inch for each two stories or part thereof. Provided, however, that such walls shall support only their own weight, and that such walls have steel rods three-quarters of an inch in diameter or of an equivalent area set vertically, and spaced not more than eighteen inches apart, and steel rods five-eighths of an inch in diameter or of an equivalent area set horizontally tied to the vertical rod at each intersection with these, and set not to exceed twenty-four inches apart; and provided that where the weight of the walls of each story is not transferred to the skeleton by spandril beams, the vertical reinforcement shall be increased in weight in an arithmetical ratio of twice as much steel in the two stories next below the upper two stories, and three times as much steel in the two stories next below the upper four stories, and so on downward. Vertical bars shall be spliced together by winding with iron wire. Horizontal bars shall be wired to the columns. Additional bars shall be set around openings, the verticals wired to the nearest horizontal bars and the horizontal bars at top and bottom of openings shall be wired to the nearest vertical bars.

The steel rods shall be combined with the concrete and placed where the combination will develop the greatest strength, and the rods shall be staggered or placed and secured to the steel or reinforced concrete structural skeleton of the building, so as to resist a pressure of fifty (50) pounds per square foot, either from the exterior or from the interior on each and every square foot of each wall panel.

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Sec. 961. (Molded Hollow Concrete and Hollow Tile Block.)—Molded hollow concrete blocks or molded hollow vitrified clay building blocks of the full thickness of a ten-inch wall may be used wherever eight-inch walls are called for by this chapter, and such blocks may also be used wherever twelve-inch brick walls are called for in this chapter under frame cottages and in one and two story Class III. and Class VI. buildings.

ARTICLE XIII.

SLOW-BURNING CONSTRUCTION.

Sec. 962. (Slow-Burning Construction Defined.)—The term "slow-burning construction" shall apply to all buildings in which the structural members which carry the loads and strains which come upon the floors and roofs thereof are made wholly or in part of combustible material, but throughout which the structural metallic members shall be protected against injury from fire by coverings of incombustible, non-heat conducting material similar to those described under the head of "skeleton construction," except that plastering and metallic lath may be used as provided herein. In the case of columns the metallic lath shall be fastened to metallic furrings and the plastering upon the same shall be of three coats of mortar. The lower five (5) feet of each column shall be protected as required for brick, concrete or tile covering in Section 923 of this chapter. A covering of three (3) coats of plastering on metallic laths shall be considered sufficient protection for the under side of joists and girders and a layer of mortar or other incombustible material at least 1½ inches thick shall be applied on all floors and roof surfaces above the joists of the same.

Sec. 963. (Posts, Partitions and Elevator Enclosures.)—Where oak posts of greater sectional area than one hundred square inches are used, they need not be covered. All partitions and all elevator enclosures in buildings of this type shall be made entirely of incombustible material. The use of wood furring or of stud partitions shall not be allowed in buildings of this type.

Sec. 964. (Stairs.—To Be Incombustible.)—Where buildings are required by this chapter to be of "slow-burning construction," all stairs in such buildings shall be of incombustible material.

ARTICLE XIV.

MILL CONSTRUCTION.

Sec. 965. (Mill Construction Defined.)—The term "mill construction" shall apply to all buildings in which all the girders and joists supporting floors and roof have a sectional area of not less than seventy-two square inches, and above the joists of which there is laid a timber floor not less than three and three-fourths inches thick. Wooden posts used in buildings of this type shall not be of smaller sectional area than one hundred square inches.

Sec. 966. (Fireproofing.)—Partitions and elevator enclosures in buildings of this type shall be made entirely of incombustible material. If iron columns, girders or beams are used in buildings of this type, they shall be protected as specified in Section 946 of this chapter, but the wooden posts, girders and joists need not be protected by fireproof covering. The use of wood furring, wood laths or stud partitions shall not be permitted in buildings of this type.

Sec. 967. (Stairs.—To Be Incombustible.)—Where buildings are required by this chapter to be of "mill construction" all stairs in such buildings shall be of incombustible material.

APPROVED CINDER CONCRETE CONSTRUCTION.

Sec. 968. (Concrete Construction.—Approved Cinder.)—The term "approved cinder concrete construction" shall apply to all buildings in which all parts that carry weights or resist strains, all exterior walls, all interior walls, all interior partitions, all stairs and all elevator enclosures are made entirely of incombustible material, and in which all metallic structural members are protected against the effects of fire by approved cinder concrete proportioned, mixed, applied and secured as herein described. Approved cinder concrete construction may be used for all buildings in which fireproof construction is mandatory by this chapter, or where ordinary construction may be used.

Sec. 969. (Concrete.—Cinder.—Approved.)—Approved cinder concrete shall consist of a standard Portland cement, torpedo sand, and clean, thoroughly burnt steam boiler cinders, free from deleterious matter, no particle of which shall be larger than one inch.

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Sec. 970. (Cinders.—Quantity.)—The volumetric quantity of the cinders combined with the torpedo sand shall not exceed the volume of the Portland cement by eight (8) times. All of the ingredients of approved cinder concrete shall be thoroughly worked and wet so as to cover each piece of cinder with moistened cement; and the cement and sand shall fill all of the voids between the cinders.

All approved cinder concrete shall be cast and rammed in an unset condition against the metal.

The minimum thickness of approved cinder concrete covering in structural metal shall be two (2) inches. In every case the thickness of the coverings shall be measured from the extreme projection of the structural metal unless otherwise provided in this chapter.

Sec. 971. (Columns Approved.—Concrete Coverings.)—The approved cinder concrete covering of the columns shall be not less than three (3) inches in thickness from the extreme projection of the metal, including the plastering, and in all cases the cinder concrete shall be rammed solid against the column metal, filling all channels and open spaces within the perimeter of the finished plaster column. Approved cinder concrete column covering shall have metal binders of No. 8 gauge wire imbedded in and around the columns for each sixteen (16) inches in height of the column, provided, however, that in buildings of approved cinder concrete construction the columns may be covered with one thickness of metal, furring metal, metal lathing and not less than three coats of mortar.

In places where there is trucking or wheeling, or handling of packages of any kind, the lower five (5) feet of every column shall be incased in a protective covering such as is described in Section 923 of this chapter.

Sec. 972. (Beams and Girders.—Approved Cinder Concrete Construction.)—The beams and girders of a building built of approved cinder concrete construction shall be enclosed in approved cinder concrete which shall be not less than two (2) inches in thickness at any and all points of the structural metal work. The approved cinder concrete covering shall be reinforced with metal clips or wire binders, either or both of which shall not be more than sixteen (16) inches on centers in the direction of the length of the structural member.

The top of all girders or beams shall be protected with not less than two (2) inches of approved cinder concrete.

A floor or roof construction of approved cinder concrete may be used for any span between structural members that will carry the test loads required by this chapter for such floors and roofs.

Sec. 973. (Segmental Arches.)—Segmental arches shall be not less than three (3) inches in thickness at the crown.

Sec. 974. (Floors.—Flat Slab Construction.)—Flat slab construction shall be not less than four (4) inches in thickness for spans of eight (8) feet or less. Flat slab floor construction shall be not less than five (5) inches in thickness for spans between eight (8) and ten (10) feet.

Approved cinder concrete shall not be used as a floor or roof construction unless such approved cinder concrete is reinforced by steel or iron, and such reinforcement shall not weigh less than three-quarters of a pound per square foot of superficial surface.

All reinforcing steel shall be completely enclosed by the concrete.

Wood nailing strips for floor surfacing may be used in buildings of approved cinder concrete construction, provided, however, that such nailing strips shall be imbedded as described in Section 934 of this chapter.

Sec. 975. (Partitions.)—The partitions in buildings of approved cinder concrete construction shall be as described in Section 935 of this chapter for partitions in fireproof buildings, provided, however, that partitions may be built wholly of metal studding, metal lath and plaster, but no such partitions shall be of a less thickness than one and one-half (1½) inch.

The partitions around stairs, or stair halls, or shafts, or elevators, or public lavatories, shall be wedged tight between the structure of the floors and ceilings, or if such partitions are of plaster, the metal or metal studding shall be secured to the structure by clips, bolts or other metal fastening, and in no case shall any such partition be built on the wood flooring or wood nailing strips.

Sec. 976. (Walls.—Enclosing.)—The enclosing walls, the covering of exterior side of mullions, beams, girders, lintels, the enclosures of pipes, pipe shafts, the doors into shafts, windows into shafts, covering of girders, covering of trusses, cut-out boxes, chases, stairs, landings, painting, rivets, bolts, and all other items required in these sections on fireproof construction and in the sections on skeleton construction shall, in buildings of approved cinder concrete construction be designed or built or covered,

or made of the material called for, or any one or a number of these requirements, as described in such sections describing the requirements of skeleton construction or of fireproof construction in this chapter, provided, however, that approved cinder concrete as described herein may be used for all protective covering of structural metal.

ARTICLE XV.

ORDINARY CONSTRUCTION.

Sec. 977. **(Ordinary Construction Defined.)**—The term "ordinary construction," as used in this chapter, means the ordinary system of construction in which timber and iron structural parts are not protected with fire resisting coverings.

ARTICLE XVI.

GENERAL CONSTRUCTION REQUIREMENTS.

Sec. 978. **(Construction or Alteration of Buildings.)**—Every building or structure, or part thereof, hereafter constructed, erected, altered, enlarged or changed anywhere within the city, shall be so constructed, erected, altered, enlarged or changed only in accordance with the provisions of this chapter.

Sec. 979. **(Materials.)**—Materials used in the construction of buildings of all classes shall conform to the following specifications:

Sec. 980. **(Foundation Proportions.)**—Foundations shall be proportioned to the actual average loads they will have to carry in the completed and occupied building.

Sec. 981. **(Foundation Construction.)**—Foundations shall be constructed of either of the following: Approved cement concrete, dimension or rubble stone, sewer or paving bricks or iron or steel or piles. If iron or steel is used the filling and the coating of the same shall be of Portland cement as provided in Section 992 of this chapter, piles shall be covered with grillage of timber, concrete or steel, or a combination of these. Where timber grillage or timber piles ar used, the top of such grillage or such piles shall be at least one foot below city datum.

Sec. 982. **(Foundation of New and Old Walls.)**—In all cases where there is an increase in the thickness of walls, a new foundation shall be built in such manner as to carry jointly both the new and old walls, and the soil under such foundations shall not be loaded beyond the limits hereinbefore specified in this chapter. All foundations shall be protected against the effects of frost, and frozen cement mortar shall not be used in connection with building operations.

Sec. 983. **(Foundations.—Pile Borings Required.—Safe Load Required.—Fiber Stress.)**—Where pile foundations are used, auger borings of the soil shall first be made to determine the position of the underlying stratum of hard clay or rock, and the piles shall be made long enough to sustain the required load according to approved formulas for pile driving, and timber piles shall not be loaded more than twenty-five tons to each pile. The heads of the piles are to be protected against splitting while they are being driven, and after having been driven the piles are to be sawed off to a uniform level and covered with a grillage so proportioned that in the transmission of the load from the structure to the pile the extreme fiber stress of the grillage shall not exceed the safe limits for the respective materials as prescribed in this chapter. The safe compression load per square inch on concrete in concrete piles shall not exceed four hundred pounds. The area of the cross section shall be measured at a point six (6) feet below the head of the pile after the same has been set in place, and the cross section of the pile above this point shall not be reduced.

Sec. 984. **(Foundations Other than Pile.)**—If foundations of other materials than piles are used, they shall be so proportioned that the loads upon the soil shall not exceed the limits for different kinds of soil than those hereafter given, to-wit:

Sec. 985. **(Load for Various Soils.)**—If the soil is a layer of pure clay at least fifteen feet thick, without admixture of any foreign substance excepting gravel, it shall not be loaded more than at the rate of three thousand five hundred pounds per square foot. If the soil is a layer of pure clay at least fifteen feet thick, and is dry and thoroughly compressed, it may be loaded not to exceed the rate of four thousand five hundred pounds per square foot.

Sec. 986. **(Load for Sand Fifteen Feet Thick.)**—If the soil is a layer of dry sand fifteen feet or more in thickness, and without admixture of clay, loam or other foreign substance, it shall not be loaded more than at the rate of four thousand pounds per square foot.

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Sec. 987. (Load for Mixed Soil.)—If the soil is a mixture of clay and sand it shall not be loaded more than at the rate of three thousand pounds per square foot.

Sec. 988. (Foundations in Wet Soil.—Trenches to Be Drained.)—In all cases where foundations are built in wet soil, it shall be unlawful to build the same unless the trenches in which the work is being executed are kept free from water by bailing, pumping or otherwise, until after the completion of work upon the foundations, and in each case a connection with the street sewer shall be established before beginning the work of laying foundations.

Sec. 989. (Foundations.—Where Not Permitted.)—Foundations shall not be laid on filled or made ground or on loam, or on any soil containing admixture of organic matter.

Sec. 990. (Foundations.—Depth Below Surface.—Least Limit.—Depth Regulated by Sewer.—Exceptions.)—Foundations shall in all cases extend at least four feet below the surface of the ground upon which they are built, and in the case of all buildings forty feet or more in height, foundations shall extend at least to the depth drained by the street sewer in the neighboring streets or alleys; but if such sewers are at a greater depth than ten feet below the sidewalk grade, such foundations need not extend to a greater depth than ten feet, provided that sound, hard soil is found at that depth.

Sec. 991. (Concrete.—Broken Stone.—Sand.—Cement.—Mortar.—Foundations Of.)—Broken stone or concrete in making foundations shall be clean and free from dirt and dust. And sand shall be free from admixture of loam and shall be otherwise clean and sharp.

Cement shall have been kept dry and shall be used fresh from the package; cement which has been permitted to become wet, hard or lumpy before it is mixed into the mortar or concrete shall not be used.

The use of concrete or mortar of any kind, the ingredients of which are not thoroughly and completely mixed and which are not free from lumps, or other unmixed portions of any of the ingredients, is prohibited; and also the use of cement mortar which has become partly or wholly set before use. Concrete foundations wherever used shall have boxes of plank all around them, and the concrete shall be well rammed in individual layers not more than six inches each in thickness. The ramming shall be continued until the water stands on the top of the mass of concrete.

Sec. 992. (Steel Rails or Beams in Concrete.)—If steel or iron rails or beams are used as parts of foundations, they shall be thoroughly imbedded in a concrete, the ingredients of which shall be such that after proper ramming the interior of the mass will be free from cavities, the beams or rails shall be entirely enveloped in concrete, and around the exposed external surfaces of such concrete foundations there shall be a coating of a standard cement concrete not less than four inches thick.

Sec. 993. (Concrete Foundations.—Steps.—Safe Load Where Reinforced by Beams.)—If concrete foundations are used by themselves and without the insertion of iron or steel beams or rails, the offset on top of same shall not be more than two-thirds the height of the respective courses, and such concrete foundations shall not be loaded more than twenty-five thousand pounds per square foot. If reinforced by iron or steel beams or rails, the loads and offsets in the same shall be so adjusted that the fiber stress upon the metal, if iron, shall not exceed twelve thousand pounds per square inch, or, if steel, that the fiber stress shall not exceed sixteen thousand pounds per square inch.

Sec. 994. (Dimension Stones.—Safe Load.)—Dimension stones shall have uniform beds and the offsets in the same, where two or more layers are used, shall not be more than three-quarters of the height of the individual stones. They shall be set with full beds of cement mortar under their entire area, and in such manner that they will not rock after being set. Dimension stones in foundations shall not be subjected to a load of more than twenty thousand pounds per square foot in tiers.

If the beds of the stones are dressed and leveled off to a uniform surface and the stones are set in a standard cement mortar, this strain may be increased to twenty-five thousand pounds per square foot.

Sec. 995. (Rubble Stone.)—Rubble foundations and rubble walls shall be built of approximately square and flat bedded stones, well and thoroughly bonded in both directions of the walls, each stone thoroughly bedded in mortar under its entire area. Wherever walls of any kind are used as curb walls, their exterior surfaces shall be rendered approximately water tight by a coating of a standard cement mortar.

Sec. 996. (Brick.—Soft.—Use Of.—Bond.—Safe Load.)—The use of soft bricks is prohibited in all parts of buildings exposed to the weather and in internal or external piers or bearing walls. The bond of brick work shall be formed by laying one course of headers for every five courses of stretchers. Brick work in walls laid

in a standard Portland cement mortar shall not be loaded more than twenty-five thousand pounds per square foot. Brick work laid in an ordinary cement mortar shall not be loaded more than eighteen thousand pounds per square foot. Brick work in walls laid in lime mortar shall not be loaded more than thirteen thousand pounds per square foot.

Sec. 997. (Walls.—Ledges.—Joists Supports.)—Whenever walls sixteen inches or less in thickness shall be used for the support of ordinary joists in buildings of all classes, ledges of the thickness of the furring, lath and plaster shall be formed between such joists and shall be carried up and leveled off on the line of the tops of the joists, or standard cast iron joist boxes shall be used for the support of such joists.

Sec. 998. (Walls Around Stairs, Elevators and Shafts.)—Where a stairway or an elevator shaft or an air shaft is surrounded by brick walls, such surrounding brick walls may be built sixteen (16) inches thick, excepting that the upper fifty (50) feet of the height may be built twelve (12) inches thick, but the length or breadth, or either, of such a stairway or elevator shaft or air shaft shall not exceed twenty-five (25) feet, and in no case shall the load on the brick of such wall or walls exceed the safe limits of load specified for brick work in this chapter.

Sec. 999. (Pressed Brick Facing.—Bond Joints.)—If pressed brick facings are used, they shall be bonded into their backing every seventh course. Bond shall be established by solid headers or by blind headers. In the case of piers faced with pressed brick, only solid headers shall be used, but bond stones or iron bond plates may be substituted for such headers. Pressed brick in all cases shall be so laid as to have a full bed of mortar under its entire surface. The laying of pressed brick merely with a joint all around the outer edge of the bricks shall be unlawful.

Sec. 1000. (Brick Piers.—Offsets.—Bond Stone.—Cap Stone.)—In building brick piers there shall be provided at every offset in each pier, or at every point where such brick pier receives the load, a bond stone at least eight inches thick or a plate of rolled iron or steel not less than one-fourth of an inch in thickness, which stones or plates, if at the top of such pier, shall cover its entire surface, and shall in all cases be adapted to receiving the load to be imposed and shall be made of a strength which will keep the fiber strain upon the material used within the limits elsewhere herein stated.

Sec. 1001. (Stone Facing Without Bond Courses.)—Stone may be used as facing for brick walls under the following conditions: If the facing is ashlar, without bond courses, and the individual course thereof measure in height between bond stones more than six times the thickness of the ashlar, then each piece of ashlar facing shall be united to the brick work with wrought iron anchors at least two to each piece and reaching at least eight inches over the brick wall, and hooked into the stone facing as well as the brick backing. Wherever ashlar as before described is used, it shall not be counted as forming part of the bearing surface of the wall, and the brick backing shall be of the thickness of wall herein specified for the different kinds of building.

Sec. 1002. (Stone Facing with Bond Courses.)—If stone facing is used with bond courses at a distance apart of not more than four times the thickness of the ashlar, and where the width of bearing of the bond courses upon the backing of such ashlar is at least twice the thickness of the ashlar, and in no case less than eight inches, then such ashlar facing shall be counted as forming part of the wall and the total thickness of wall and facing shall not be required to be more than herein specified for walls of the different classes of buildings.

Sec. 1003. (Stresses.—Cast Iron.—Fiber.—Strains.—Length.)—The stresses in materials used in construction produced by the calculated strains due to their own weight and applied loads shall in no case exceed the following:

CAST IRON.

Extreme fiber strain tension	2,500 lbs.
For columns	10,000 lbs.

Reduced by Gordon's formula. Reduced for eccentric load.

No cast iron column shall have a length to exceed twenty-four times its diameter, or least side.

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Sec. 1004. STRESSES IN POUNDS PER SQUARE INCH.

	Wrought Iron.	Steel.
Extreme fiber stresses, "I" beams and shapes	12,000	16,000
Extreme fiber stresses, built beams	10,000	15,000
Tension	12,000	15,000
Shearing	7,500	10,000
Direct bearing pins and rivets	15,000	20,000
Bending on pins	18,000	22,500
*For columns and compression members	12,000	15,000

*Reduced for ratio of length of columns to its least radius of gyration by approved modern formulas, and reduced for eccentric loading.

Sec. 1005. TIMBER—STRESSES IN POUNDS PER SQUARE INCH.

	On Extreme Fiber	Shearing Along Grain	Compression Perpendicular to Grain
White Pine and Spruce	750	80	150
White Oak	1,000	150	250
Long-leaved Yellow Pine	1,250	100	250

Sec. 1006. (Posts with Flat Ends.—Stresses per Square Inch.)—

L. Length of posts in inches.

D. Least side or diameter of post in inches.

S. Stress per square inch.

White Pine Spruce.		L. L. Yellow Pine.		White Oak.
L. D.	S.	L. D.	S.	S.
0-10	625	0-15	1,000	750
10-35	475	15-30	875	650
35-45	375	30-40	750	560
45-50	300	40-45	625	460
		45-50	500	375

Sec. 1007. (Walls.—Eight-Inch Brick Wall.—Height Limited.)—In no case, in any class of building, shall any eight-inch brick wall be more than fourteen feet in height.

GENERAL PROVISIONS.

Sec. 1008. (Cement Concrete Walls.—Solid.)—Approved cement concrete of the same thickness as is required where common brick or rubble stone, may be substituted for either of these materials wherever either is called for in this chapter.

Sec. 1009. (Walls.—Thickness Of.)—The thickness of walls set forth in the tables for the various classes of building shall, for each class of buildings, apply to all external enclosing walls, and also to such internal walls as may be required under the specifications of the different classes of buildings.

Sec. 1010. (Bay Windows and Light Shafts.—Material For.)—Bay or oriel windows and light shafts may be built of combustible material, as specified in Section 307 of this ordinance.

Sec. 1011. (Buildings.—Height Of.)—The limits of heights of buildings hereinbefore given for non-fireproof buildings, shall be from the average established sidewalk level to the highest point of roof thereof.

No buildings shall be erected in the city of greater height than two hundred and sixty feet from the sidewalk level to the highest point of external bearing walls. The erection of parapet walls or of balustrades constructed entirely of incombustible material is permitted above the roof level of buildings of all classes, and in addition to the heights herein fixed for the same. (See Sections 944 and 945.)

Sec. 1012. (Floor Areas.—Computation Of.—For All Classes of Buildings.)—Stairs in Common.)—The floor areas of all buildings shall be computed from the dimensions taken on the inner side of the exterior or surrounding walls on the floor of the third story, and the areas of courts, of elevator shafts, of enclosed stairs, if enclosed with incombustible materials, and of chimneys, shall not be considered as a part of such floor areas.

Where two areas of the same building adjoin, and are separated by fireproof dividing walls, they may have a stairway in common. Provided, however, in fireproof buildings such stairways shall be of incombustible material, enclosed in fireproof partitions, and access to such stairway shall be direct from each such area. Provided, however, in buildings of mill, slow-burning or ordinary construction, such stairways shall

be of incombustible materials, enclosed by brick walls, and that doors to such stairways shall be automatic, self-closing standard iron doors, as described in Section 110 of this chapter, and all materials inside of such brick walls shall be fireproof or incombustible material.

Sec. 1013. **(Wind Pressure.—Precautions Against.)**—In the case of all buildings the height of which is more than one and one-half times their least horizontal dimension, allowances shall be made in both vertical and horizontal construction for wind pressure, which shall not be figured at less than thirty pounds for each square foot of external wall surface.

Sec. 1014. **(Basement.—Meaning Of.)**—Wherever in this chapter the words "basement story" are used, it is intended to mean that the floor of such story is at a distance of two feet or more below the level of the sidewalk, and that its height does not exceed eleven feet in the clear. If the floor of such story is nearer than two feet to the sidewalk grade, or if the ceiling of such basement is more than nine feet above the sidewalk grade, it shall be counted as the first story of the building in which it occurs; except in buildings of Class VI. and Class VIII. as defined in Section 610 of this chapter.

Sec. 1015. **(Cellar.—Meaning Of.)**—Cellar is a story, the height of which is more than two-thirds below the level of the grade at the building.

Sec. 1016. **(Sub-Basements and Cellars.—Construction Of.)**—No building may have more than one basement or cellar of ordinary or slow-burning or mill construction, all additional basements or cellars shall be of fireproof construction, as described in this chapter, all elevator enclosures shall be of brick from the lowest basement floor level to the first story floor, and all stairways shall be enclosed in fireproof partitions from the lowest basement floor level to the first story floor level with automatic closing standard iron doors, opening outward.

In cases where a pipe, conduit, dumb-waiter, cable, wire, conveyor or belt, or any combination thereof passes from one basement to another through a floor the opening in the floor shall be enclosed as specified in Sections 925, 926 and 927 of this chapter.

The number and width of stairs from the lowest basement floor to the first story shall be the same as required for the four highest stories of a building of the same area.

Sec. 1017. **(Enclosures Upon Roofs.—Parapets and Balustrades Upon Roofs.)**—It shall be permitted to erect on the roofs of all buildings more than sixty feet and less than one hundred feet high, skylights, enclosures for water tanks and enclosures for elevator machinery, the construction of all of which enclosures shall be entirely of incombustible material; provided, however, that the roofs of same may be built of mill or slow-burning construction.

Sec. 1018. **(Fire Walls.—When Dispensed With.)**—Fire walls of brick not less than twelve inches thick shall be built extending above the roofs of buildings if such roofs are flat, and also above the roofs of all buildings where the same abut against another building, or where the same stand upon any line of any lot, excepting street or alley lines. Provided, that where eight-inch walls are permitted in the top story of buildings, or as provided in Classes III. and VI. for buildings not over three stories high, the fire walls shall be of the same thickness. Such fire walls, where they stand upon lot lines, or where they are over the dividing walls in the interiors of buildings where such are called for by this chapter, by reason of the great area of such buildings, shall extend at least three feet above the roofs of such buildings. Fire walls upon street and alley lines shall extend not less than eighteen inches above the roofs of such buildings. Fire walls may be dispensed with on street and alley lines if the tops of the roof boards and roof joists are protected against fire for a distance of at least five feet from such street or alley lines by a coating of deafening mortar on hollow tile or porous tile at least two inches thick. Fire walls at street and alley lines may also be dispensed with in all cases where the entire framing and materials of the roof shall be made strictly fireproof.

Walls facing upon courts and light shafts shall be treated as in the same category with walls facing upon streets and alleys.

Fire walls shall be covered with a weatherproof coping of incombustible material.

Sec. 1019. **(Window and Door Sills Incombustible.)**—Window and door sills shall be made of incombustible material. Oak timber used for door sills and not less than eight inches thick by the full width of the wall in which such sills occur, shall, for the purpose of this chapter, be counted incombustible, but no other form or use of wood construction shall be considered incombustible.

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Sec. 1020. (Store Fronts.—Columns and Lintels Supporting.)—The columns and lintels supporting store fronts in buildings within the fire limits of more than one story in height shall be made of incombustible material.

Sec. 1021. (Roofs.—Shingle or Gravel.)—The use of shingle roofs or of other forms of combustible roof covering upon buildings erected or altered within the fire limits is prohibited. Provided, however, that shingle roofs may be placed on buildings not exceeding two stories in height and two thousand square feet in area, but the shingles used on such roofs shall first have been dipped in fire-resisting paint, such fire-resisting paint to be approved by the Commissioner of Buildings.

Roofs whose slope is not more than three inches per foot horizontal, and the covering of which is made with a composition of felt and gravel, shall be considered incombustible under the provisions of this chapter, and may be used upon buildings of all classes.

Sec. 1022. (Roofs.—Construction Of.—Pitch Of.)—In the case of all buildings less than sixty feet in height, roofs having a slope of more than that specified for composition roofs, may be made of timber and board construction, and shall be covered with incombustible material, except as provided in Section 1021 of this chapter. The roofs upon buildings sixty or more feet and less than ninety feet high, and of greater slope than three inches to the foot and less slope than thirty degrees with the horizon, shall, if made of timber construction, have an incombustible covering upon the roof boards, which shall be made either of mortar or porous terra cotta or plaster boards, or other incombustible material, and which shall be at least two inches thick. If this covering is made upon the roof boards, wooden strips shall be inserted and securely fastened to the wooden substructure at regular intervals between the incombustible covering, and a weatherproof covering of incombustible material.

Sec. 1023. (Roofs.—Strength Of.)—The roofs of all buildings of every kind and class shall be designed and constructed in such a manner that they will bear a load in addition to the weight of their structure and covering of at least twenty-five pounds for each square foot of horizontal surface.

Sec. 1024. (Roofs.—Pipes Carrying Water From.)—The water from all roofs shall be carried to the street sewers in metal conductor pipes, which shall be continually maintained in such condition that leaks therein will not cause the water to soak into the walls or any other part of the building.

Sec. 1025. (Cornices.—Gutters.—Eaves.—Parapets.—Bay Windows.)—Where sheet metal cornices or external metal sheet gutters are used, their entire framework and covering shall be of metal, and the walls shall extend behind all such cornices or gutters along their entire height. All metal work in and about any cornice, gutter, eave or parapet, or in or about any bay, or oriel window, shall be supported by suitable brackets placed not more than four feet apart and firmly secured to the wall. Wood shall not be used as the support of any gutter or cornice for buildings of one hundred feet or more in height.

Sec. 1026. (Towers.—Domes and Spires.—Construction Of.)—Towers, domes and spires may be built on top of the roofs of buildings, but shall not occupy more than one-fourth of the street frontage of any building. Such towers, domes or spires, if any part thereof is built to a height of more than sixty feet and less than ninety feet, shall be of slow-burning construction, and if of greater height than ninety feet above the sidewalk shall be of fireproof construction; and in all cases where the area of such spire, dome or tower exceeds one hundred square feet, its supports shall be carried down to the ground, and shall be, if the construction supported is more than sixty feet and less than ninety feet high, of slow-burning construction, and if more than ninety feet high, of fireproof construction.

Sec. 1027. (Skylights.—Construction Of.—Glass In.)—Any skylight on the roof of any building, other than a frame building, shall have the sides, sashes and frames constructed of metal; or of wood, metal clad on all exterior surfaces.

The glass in all such skylights, except in buildings of Classes III. and VI. not exceeding three stories in height shall have at least six inches over same, a strong wire netting (wire not lighter than No. 8 and mesh not coarser than one and one-half inch by one and one-half inch), unless the glass contains a wire netting within itself.

Sec. 1028. (Porches.—Verandas.—Porticos.—Balconies.—Construction of Inside Fire Limits.)—If verandas, porches or porticos are enclosed, the enclosing walls shall be made of incombustible material, the only exception being in case such porticos or verandas are to be made part of a storm house or of a storm door enclosure,

which, however, shall in no case be more than twelve feet high, nor shall it occupy a greater frontage than two feet more than the width of the inner doors for which the storm doors are made.

Sec. 1029. **(Sidewalks.—Occupation of by Parts of Buildings.)**—The use of any part of the sidewalks for steps or for open areas is prohibited.

Sec. 1030. **(Chimneys.—Walls Of.)**—No chimney shall be built with less than four inches thick brick wall, and no chimney having a greater flue area than two hundred and sixty square inches shall have walls less than eight inches thick; provided that in all cases where chimneys are built with walls less than eight inches thick the same shall have flue liners of fire clay or terra cotta in their entire length. Except that where flues are to be used for gas grates or gas ranges only, the flue lining may be omitted, but the inside of the flue shall be smoothly plastered. The use of unprotected metal flues inside of buildings will not be permitted.

Sec. 1031. **(Chimneys.—Height Above Roof.)**—Every chimney having an area of not more than two hundred and sixty square inches shall be carried up to at least five feet above the highest part of the roof of the building of which such chimney is a part, if such roof is a flat roof. If the roof is a pitched roof the chimney shall be carried up at least two feet above the highest point of same.

Sec. 1032. **(Chimneys.—Interior.—Walls Of.)**—Chimneys having a greater flue area than six hundred square inches shall, if built of brick, have surrounding walls of at least sixteen inches of brick work, and such walls shall be built hollow with at least four inches hollow space in such walls, at a height of fifty feet above smoke inlet the thickness of the surrounding brick work may be reduced to twelve inches, but in all cases the surrounding walls of chimneys of this or any other size shall be so proportioned that the brick work in same will not be subjected to a greater stress than elsewhere herein fixed as a maximum safe stress for brickwork. For chimneys having a greater flue area than one thousand six hundred square inches the thickness of walls shall be increased above the thickness above specified, four inches for each increase of one thousand square inches or fractional part thereof.

Sec. 1033. **(Chimneys or Flues.—Height above Roof.)**—All flues having a greater area than two hundred and fifty square inches, and not more than six hundred square inches, shall be carried up at least twelve feet above the highest point of roof or building of which they form part; and all flues having a greater area than six hundred square inches and not more than nine hundred square inches, shall be carried up at least twenty feet above highest point of roof. All chimneys having a greater area than nine hundred square inches shall be carried to a height of at least twelve feet above any roof within a radius of sixty feet; provided that the top of the chimney shall be not less than twenty feet above the highest point of the roof of the building of which it forms a part.

Sec. 1034. **(Chimneys or Flues.—Linings Of.)**—All flues having a greater area than four hundred square inches shall be lined on the inside with insulating material, which lining shall start at least two feet below the smoke inlet, and for flues having an area of from four hundred to six hundred square inches shall extend twelve feet above smoke inlet, and for all flues of more than six hundred square inches, and not more than one thousand six hundred square inches, shall extend twenty feet above smoke inlet, and for all flues having a greater area than one thousand six hundred square inches, shall extend at least thirty feet above smoke inlet. If an internal smoke pipe of metal is used, so much of the brick work as is inside of the insulating cavity of the stack may be omitted. Metal smoke-stacks shall, however, be lined with insulating material for at least thirty feet of their height.

If internal stacks in buildings be made of metal then they shall be entirely surrounded within the building with a fireproof material which shall thoroughly protect the building from fire, and there shall be an air space, not less than four inches in the smallest part between the fireproofing and the metal stack.

Sec. 1035. **(Chimneys.—Interior.—Framing Around.)**—No joists or girders shall rest and be supported on the walls of any chimney, and the framing around chimneys of all kinds shall be so constructed that in no case will any joists or timbers be placed nearer than two inches from the outside face of walls of flues, and in no case shall the distance from the inside of any flue to any joists or timbers be less than seven inches.

The foregoing shall apply only to chimneys which are enclosed by, or form part of, the interior of any building.

Sec. 1036. **(Chimneys.—External.—Location Of.)**—Chimneys may be built outside of the walls of existing buildings (but not in such manner as to encroach upon any street or alley), and shall be built as follows:

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If at least one side of such chimney abuts entirely upon the wall of an existing building and the chimney is throughout its entire length securely and firmly anchored to the walls of such existing building, the wall of such chimney may be built of hollow tiles, in which case, however, it shall have a cast iron base, lined with fire brick,, and extending to a height of at least ten feet above the street or alley grade.

Sec. 1037. (Chimneys.—External.—Built of Iron or Steel.)—Such external chimney may also be built of rolled steel or iron not less than one-fourth inch in thickness, and lined with insulating material, laid in fire clay, for at least thirty feet above street or alley grade, or it may be built throughout its entire height of cast iron, in which case the first ten feet above the street or alley grade shall be lined with insulating material; provided, however, that in chimneys not exceeding five hundred square inches in flue area, the upper twenty-five feet may be constructed of steel or iron not less than one-eighth inch thick.

Sec. 1038. (Chimneys.—Isolated.)—Isolated chimneys shall be so designed and constructed that the stress upon any part thereof, due from the weight of the stack itself and from wind pressure, shall never exceed the safe limits as provided in this ordinance.

Sec. 1039. (Chimneys or Smokestacks.—Foundation Of.)—The foundations of chimneys or smoke-stacks, whether inside or outside of buildings, or whether connected with the same or isolated, shall be designed and built in conformity with the provisions relating to foundations of buildings hereinbefore given.

Sec. 1040. (Smoke Flues Passing Through Partitions.)—Where smoke flues of diameter of six inches or less pass horizontally through a wood or a plastered stud partition, they shall be surrounded by a ventilated thimble of incombustible material.

Where a smoke flue of a greater diameter than six (6) inches passes through a wood or plastered stud partition, it shall be surrounded either by a body of brick, hollow tile, porous terra cotta or other incombustible substance, measuring at least eight (8) inches all around such smoke flue. Smoke flues of less diameter than twelve inches shall be kept at least twelve inches distant from any combustible partition, ceiling or floor, and such woodwork immediately over and for a distance of two feet on each side of such smoke flue shall be covered with sheet metal or with porous terra cotta, hollow tile or with plaster.

Sec. 1041. (Smoke Flue.—Woodwork Around.)—Smoke flues of greater diameter than twelve inches and less area than six square feet, shall be kept at least twenty inches away from any woodwork, and such woodwork shall be protected as before specified for the smaller smoke flues to a distance of four feet on each side of such smoke flues.

Wherever smoke flues of larger area than six square feet are used they shall be kept at least three feet distant from any woodwork, and such woodwork for a distance of at least six feet on either side of such smoke flues shall be protected as before specified for smaller flues.

Sec. 1042. (Floors.—Protection Of.—Around Boilers, Furnaces, Etc.)—Wherever steam boilers or furnaces or ovens, coffee roasters or other structures in which fires are maintained, are set inside of a building, or in a room with wooden floor or ceiling construction, the floor of the same shall be protected by a covering of brick or concrete not less than five inches thick set in mortar upon a continuous sheet metal bearing plate not less than three-sixteenths of an inch thick, all the joints of which are to be securely riveted, and the edges of which are to be turned up five inches all around. This foundation of sheet metal and brick and concrete shall extend under the whole of the fire box and ash pit of such steam boiler or furnace or other structure, and to a distance of not less than ten feet in front and at least four feet on the other three sides of same.

Sec. 1043. (Ceiling.—Protection Of.—Around Boilers, Furnaces, Etc.)—The space between the tops of such steam boiler or furnaces and any wood ceiling construction shall in no case be less than three feet, unless such boiler be a low pressure boiler, in which case such space shall be not less than eighteen inches, and the under side of such wood ceiling construction shall in all cases be protected either by three coats of plastering or metallic lath or wire netting, or at least two inches of porous terra cotta plastered on the under side, or by a covering of hollow tile with two air spaces at least one-half inch between the wood and the under surface thereof, which under surface shall also be covered with a heavy coat of plastering.

Sec. 1044. (Boilers.—Location Of.—Permit For.)—In all cases boilers shall be so placed as to give ample room between any ceiling, wall or partition to connect or operate any valves or pipes or other connections used on such steam boilers, and in buildings of 4,000 or more square feet in area, the size, number and location shall be marked on the plans before a permit is issued by the Building Department.

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Sec. 1045. (Cupolas of Foundries.)—Cupolas of foundries shall extend at least ten feet above the highest point of any roof within a radius of forty feet of such cupola, and shall be covered on top with wire netting.

Sec. 1046. (Pipes for Distribution of Hot Air.)—Where pipes are used for the distribution of hot air from a hot air furnace, such pipes shall be made of metal and shall be double. The space between the two metal pipes shall be at least one-half inch. Such pipes are to be made with air tight joints and to be securely fastened to the partitions through which they pass.

Sec. 1047. (Registers.—Openings in Floor For.)—The openings in floors for hot air registers shall be surrounded with borders of incombustible material not less than two inches wide, and firmly and securely set in place. The register boxes shall be double, the distance between the two thicknesses of tin being at least one inch.

Sec. 1048. (Pipes, Ducts and Registers.—Material For.)—Where the air conveyed through pipes is heated in an ordinary hot-air furnace, or in any other apparatus by direct contact of the air with a fire box, the material used for these double ducts, pipes and register boxes shall be bright tin, and the joints shall be double-seamed, but not soldered. Where the air is heated by contact with hot water or steam pipes, any other sheet metal may be used for the pipes, and the use of double pipes is not obligatory.

Sec. 1049. (Doors and Windows.—When Required to Be Closed.—Fire-Resisting Glass.)—Wherever the distance between doors and windows in buildings of Classes I., II., IV., V., VII. and VIII., on opposite sides of alleys or courts shall be less than thirty feet, or wherever the distance between such doors and windows and any inside lot line of any lot upon which any such building is erected is less than fifteen feet, or wherever the distance between such doors and windows and the alley line (where the alley is less than thirty feet wide) is less than fifteen feet, such windows and the glazed portion of such doors shall be made of fire-resisting glass, set in frames of incombustible material.

Where the windows in buildings of Class I. on lot line courts are less than two feet from the lot line the sashes shall be stationary.

Sec. 1050. (Class of Building Not to Be Changed Without Conforming to Provisions of This Ordinance.)—If buildings, the uses of which bring them within any of the classes mentioned in this chapter are to be applied to the uses of any other class for which a better system of construction is called for by this chapter, the construction and equipment of such buildings shall first be made to conform to the requirements of this chapter as specified for their intended use. And it shall be unlawful to apply any such building to a new or different use than that to which its structure and equipment adapts it under this chapter, unless the requirements of this chapter for such new or different use shall first have been complied with, and a permit for such alteration of use shall have been first obtained from the Commissioner of Buildings.

Sec. 1051. (Alteration of Existing Buildings.)—Nothing in this chapter contained shall be considered as requiring alterations in the construction or equipment of buildings in existence at the time of the passage of this chapter, unless such buildings shall not have sufficient or adequate means of egress therefrom or ingress thereto by reason of insufficient or inadequate stairways, or stairways improperly located, or insufficient or inadequate elevators or elevator equipment, doors, fire escapes, windows or other means of egress or ingress.

Where it shall appear to the Commissioner of Buildings that any such building has inadequate or insufficient means of egress therefrom or ingress thereto, as aforesaid, he shall notify the owner, agent, or person in possession, charge or control of such building of such fact and direct him forthwith to make such alterations and changes in the construction or equipment of such building as are necessary to be made in order to promote the safety of the occupants of such building, and of persons using the same and of the public.

If, however, it is desired to enlarge, or in any manner materially modify the construction of any existing building, or to make change in its use or occupation which will transfer it from one class as recognized by this chapter to another class, then before such enlargement or structural change or modification of building is made, or before such change in its use or occupation may be made, the entire building shall be reconstructed or modified in such manner as to bring the same when enlarged or altered, or when occupied for its new and different purposes, in accordance with the provisions of this chapter.

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Sec. 1052. (Walls of Altered Buildings.—Increasing Thickness Of.)—If the walls of a building are not of sufficient thickness to comply with the requirements of this chapter for an enlarged or modified building, then the thickness of the existing walls shall be increased by building alongside of them a new wall, which shall not, however, be less in any part thereof than twelve inches thick, and which shall be increased in thickness by four inches for at least every forty feet in the height of such wall. Such new wall shall be laid in Portland cement mortar and shall be anchored to the old wall (bonding with brick or masonry will not be considered as complying with this chapter); and if an increase in the height of the building is contemplated, the wall from the top of the old wall shall be built jointly upon the new and old walls. If solid masonry buttresses are introduced in connection with such thickening and strengthening of existing walls, the intervening wall may be reduced to eight inches in thickness, provided such buttresses are sufficient in number and in area to make the resultant structure of equal strength with the solid wall already specified. Provided, however, that steel or iron columns or beams may be used instead of such new wall, such columns or beams to be bolted or bonded to the existing wall in a manner satisfactory to and approved by the Commissioner of Buildings.

Sec. 1053. (Walls.—Party.)—The provisions of the preceding section shall also apply to all cases where existing party walls are to be joined to for the erection of new buildings. But in the case of party walls, which at the time of their erection were built in accordance with the terms of the city ordinances then in force, such walls, if sound and in good condition, may be used without increase of thickness for any building not higher than and of the same class as the building for which the original wall was built.

Sec. 1054. (Walls.—Erection of.—Walls and Skeleton Framework Securely Braced.)—In the erection of buildings of masonry construction, no wall shall be carried up at any time more than two stories above another wall of the same building. The walls and skeleton framework of all buildings shall be kept securely braced and otherwise protected against the effects of the weather during all building operations.

Sec. 1055. (Tanks on Roofs.—Permits.—Fees.)—It shall be unlawful for any person to construct, maintain, or to allow or permit to remain, in or upon the roof of any building in the city, any water tank of a larger capacity than four hundred gallons, unless such tank shall rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron girders set on steel plates, which rest upon a good and sufficient foundation of solid brick or stone masonry, or upon iron or steel construction; provided, however, that no water tank of a capacity exceeding four hundred gallons shall be constructed in or upon any building without first obtaining therefor a permit from the Commissioner of Buildings and paying therefor a fee of two dollars.

Sec. 1056. (Stairs and Fire Escapes.—Obstruction Of.)—It shall be unlawful under any circumstances to close up or obstruct during the occupation for business purposes of any building, the stairways or fire escapes or the approaches leading thereto, and no change in the position or construction of any such stairway or fire escape shall be made, unless the permission so to do of the Building Department first shall have been obtained.

ARTICLE XVII.

FRAME BUILDINGS.

Sec. 1057. (Permits for Raising or Altering Buildings.—Requirements.)—Permits to alter or raise frame buildings shall be given, provided they do not involve an enlargement or raising of such buildings beyond the limits of dimensions herein prescribed for frame buildings, and if the stresses upon the material thereof are kept within the safe limit of stresses herein prescribed in this chapter, and if, further, such frame building has not been damaged to any extent greater than fifty per cent of its original value by fire, wear and tear, the action of the elements or otherwise. Provided, however, where any frame building is raised for the purpose of erecting a basement story under the same, the walls inclosing such basement shall be of masonry.

Sec. 1058. (Strength of Timber Constructions.—Outside of Fire Limits.)—The provisions of this chapter as to the strength and stability of timber constructions shall also apply to the construction of frame buildings outside of the fire limits.

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Sec. 1059. (Frame Buildings Prohibited.—Exception.)—Hereafter no frame building shall be erected within the fire limits of the city, except where express provision is made in this chapter therefor.

Sec. 1060. (Frame Buildings Outside Fire Limits.)—Outside of the fire limits it shall be lawful to erect frame buildings not exceeding forty feet in height from the sidewalk to the highest point of roof. If such frame buildings have a basement story of masonry, their height above the sidewalk may be made not to exceed forty-five feet.

Sec. 1061. (Frame Buildings Inside Fire Limits.—Altered or Enlarged.)—No existing frame buildings inside the fire limits shall be altered or enlarged beyond the limit of height and dimensions described in Sections 1060 and 1064 of this chapter.

Sec. 1062. (Frame Buildings Inside the Fire Limits Changed Into Flat Buildings.—Fire Walls.)—Whenever any frame building within the fire limits shall be remodeled, altered or changed for the purpose of using the same for flats or apartments, or whenever such frame building shall be occupied for flat or apartment purposes, each suite of apartments in such building shall be separated from every other suite of apartments in such building by a wall of incombustible material, of such dimensions and thickness as required by this chapter.

Sec. 1063. (Frame Buildings.—Raising.—Requirements.—Changing Gable or Hip Roofs to Flat Roofs.)—Permission may be granted by the Commissioner of Buildings for the raising of existing frame buildings, whether within or without the fire limits, to the limits of height hereinbefore fixed for new frame buildings, and no more. The Commissioner of Buildings is also authorized to issue permits for changing gable or hip roofs of existing frame buildings to flat roofs, and for the raising of walls incident to such change. But if such hip or gable roof is changed to a flat roof and the walls raised in connection with such change, the total cubic contents included by the walls so raised and the roofs so altered shall not exceed the cubic contents originally included in such gable or hip roofs.

Sec. 1064. (Frame Buildings.—Damaged.—Repairing.—Limitations.)—It shall not be lawful to repair or reconstruct or remove any frame building which has been injured more than fifty per cent of its original cost by wear and tear, by the effects of the elements or by fire.

Sec. 1065. (Lot Lines.—Requirements as to.—Number.—Dimensions.)—Frame buildings shall not be built nearer than one foot to any line of the lot upon which they are built, street and alley lines excepted. It shall not be lawful to erect a frame building wider than forty feet nor deeper than seventy feet, unless such building be divided by a fire wall or fire walls, built of incombustible material and of a thickness to be approved by the Commissioner of Buildings, so that no more than two thousand eight hundred square feet of superficial area shall be contained in any section or part of such building, uninclosed by such fire wall. If more than one frame building is built in the direction of the depth of any one lot, such buildings shall not be built with a less distance than ten feet between them.

Sec. 1066. (Chimneys in Frame Buildings.—Chimney Flues Through Partitions.)—Chimneys in frame buildings shall be built of brick, or of hollow tile, with a double tile wall around the smoke duct; all joints, whether in tile or in brick chimneys, shall be well filled with mortar and neatly pointed on the outside. Brick chimneys shall have flue linings of fire clay on the inside where the inclosing walls are less than eight inches thick. The wood framing of frame buildings shall be trimmed around chimneys in such manner as not to come within two inches of the same.

Metal smoke pipes or tile flues of single thickness shall not extend through the floors or through the ceiling or roof of any building; and where such smoke pipes or tile flues pass through partitions the woodwork of such partitions shall be protected either by a course of brick built all around such smoke pipes or tile flues, or by a thimble made of bright tin, the two rings thereof being at least three inches apart, with proper ventilating holes provided in the outer covering of the same on both sides of the partitions.

Sec. 1067. (Frame Buildings Carried to Uniform Height.)—Frame buildings, the different parts of which are of different heights, may be carried up to a uniform height, provided the greatest height thereof does not exceed the limits of height prescribed in this chapter for frame buildings.

Sec. 1068. (Basement or Story Placed Beneath Frame Buildings.)—A frame building may be raised for the purpose of erecting a basement or story, or both, thereunder, but the principal floor of such frame building shall not be raised to a higher level than sixteen feet above the sidewalk grade of the sidewalk upon which such premises abut. The walls inclosing such basement or story shall be of masonry and not less than twelve inches thick, excepting that when a one-story frame building is

raised and has a basement only built thereunder the masonry wall of such basement may be eight (8) inches thick above grade and twelve (12) inches thick below. The foundations of such walls shall be constructed as provided in this chapter. Provided, however, that no frame building shall be raised for the purpose of constructing a basement or story, or both, under the same to a greater height to the top of its roof than that elsewhere herein given as the maximum height above grade for frame buildings. The thicknesses of walls hereinabove required shall also apply to new frame buildings.

Sec. 1069. **(Sheds.—Frame.—Requirements.)**—Sheds not exceeding fourteen feet in height from the ground at the highest point thereof, and not exceeding three hundred feet in area, with an incombustible roof, may be constructed of wood within the fire limits. Such sheds shall not be located on the front part of any lot, nor shall they be used as a dwelling or as an addition to a dwelling house, or for any business purpose whatever, nor shall more than one shed be erected on any one building lot of twenty-five feet in width.

Sec. 1070. **(Sheds.—Open Shelter.—Height of Walls and Foundation.)**—Open shelter sheds may be constructed within the fire limits, provided they have incombustible roofing and the highest point of the roof thereof is not over fifteen feet above the ground, and provided that the roofing be supported on sufficient posts or piers. Such sheds shall have no combustible inclosing walls or wooden floors. No fence shall be used for the back or sides of such shed.

If it is desired or intended to inclose an open shelter shed, the inclosing walls shall be made of brick, stone, hollow tile or other incombustible material, and such walls shall have foundations extending to solid ground and at least four feet below the surface of the ground.

Sec. 1071. **(Sheds.—Coal Sheds Along Railroad Tracks.)**—Open shelter sheds to be used for the storage or handling of coal may be erected within the fire limits upon, along or adjacent to steam railroad tracks or along navigable waters; provided, such sheds shall have incombustible roofing and shall not exceed thirty-five feet in height from the ground to the highest point of the roofing. If it is desired or intended to inclose any such shed, inclosing walls thereof shall be covered with incombustible material. No such coal shed shall be built upon any lot or parcel of ground fronting upon any street within seventy-five feet of any building used exclusively for residence purposes, unless the consent of the owners of the majority of the frontage on both sides of such street between the two nearest intersecting cross streets shall first have been obtained by the person or corporation desiring to erect and maintain such coal shed.

Sec. 1072. **(Lumber or Junk Yards.—Lumber or Junk Not to Be Piled Near Residences Except by Consent.)**—No person or corporation shall establish, maintain, conduct or operate any lumber yard or place at, upon or in which new or second-hand lumber is kept for sale or is stored for seasoning or drying, or where old iron or junk is kept or stored on any premises fronting on any street in any block where two-thirds of the buildings on any street bounding any such block are used chiefly for residence purposes, unless the written consent of the owners of a majority of the frontage on both sides of all the streets bounding the block in which it is proposed to locate, establish, conduct or maintain such lumber yard or place be first obtained by the person or corporation desiring to establish, maintain or operate such lumber yard or place consenting to the issuance of a license for the establishment, keeping or maintenance of such lumber yard or place; and such written consents shall accompany the application for a license made by such person or corporation.

Sec. 1073. **(Lumber Not to Be Piled Near Planing Mills, Woodworking Establishments or Private Residences.)**—No person or corporation shall pile or store, or cause to be piled or stored, any lumber for the purpose of seasoning or drying the same or storing same or keeping such lumber for sale at any point within fifty feet of any planing mill, woodworking manufactory or private residence, unless same has been erected since the establishment of such yard.

Sec. 1074. **(Grand Stands.—Frame.—Within the Fire Limits.—Frontage Consents.)**—Wooden grand stands or tiers of seats commonly known and described as grand stands, may be erected within the fire limits where no part of any such structure shall be within sixty feet of any other building or structure, provided that the person or corporation desiring a permit for the construction of such a grand stand shall first obtain the consent in writing of the owners of a majority of the frontage on both sides of the street or streets on each side of the block or square in which it is desired to erect such grand stand.

Sec. 1075. **(Ice Houses.)**—Houses to be used exclusively for the storage of ice may be constructed within the fire limits, of wood with incombustible roofing; the walls to be inclosed with an envelope of incombustible material; eight-inch brick or

tile or approved cement concrete walls with proper foundations of masonry shall be used for such envelopes, and such houses shall be used for no other purpose than the storage of ice.

ARTICLE XVIII.

ELEVATORS AND HOISTWAYS.

Sec. 1076. **(Elevators, Passenger and Freight.—Permit for Construction.—Fee.)**—Before proceeding with the construction of any passenger or freight elevator, except such as are hereinafter specially exempted from the provisions of this chapter, there shall be obtained from the Commissioner of Buildings by the owner or agent of the building in which such elevator is to be constructed or by the contractor who is about to construct such elevator a permit for such construction, and it shall be unlawful for any such owner, agent or contractor to permit or allow the construction of any such elevator, or to proceed with, or in or about any of the work of construction of any such elevator until such permit shall first have been obtained. Such permit shall be issued by the Commissioner of Buildings after application shall have been made to him in writing therefor by any such owner, agent or contractor, specifying the number and kind of elevators which it is desired to construct and the location of the building or structure in which the same is or are to be placed, such application shall be accompanied with such plans and specifications as may be necessary to advise and inform said Commissioner of the plan of construction, type of elevator and location thereof. If such plans and specifications shall show that such elevator or elevators is or are to be constructed or erected in conformity with the provisions of this ordinance, the Commissioner shall approve the same and shall issue a permit to such applicant upon the payment by such applicant of a fee of two dollars for each elevator to be constructed and erected, and such fee shall be known as a construction fee, and shall not be held to cover the cost of any inspection which shall at any time thereafter be made of such elevator or elevators when constructed or any of the equipment thereof.

Any person, either as owner or agent of any building or structure in which any elevator or elevators is or are to be constructed, or any contractor engaged in erecting or constructing such elevator or elevators, who shall allow to be erected or constructed, or who shall attempt to erect or construct any elevator or elevators in any building or structure, without having previously obtained the permit herein required, and without having complied with the provisions of this section, shall be fined not less than fifty nor more than two hundred dollars for each offense.

Sec. 1077. **(Testing of Safety Devices.)**—Every passenger or freight elevator hereafter constructed (except such are hereinafter excepted from the provisions of this ordinance) in any building within the city shall be provided with some efficient device to secure the safe operation of such passenger or freight elevator in its running up or down, and such device shall be subjected to such practical test as may be determined by the Commissioner of Buildings to ascertain the efficiency of such safety device to properly perform the service for which it is intended; and it shall be the duty of the Commissioner of Buildings to cause to be made such test of each and every device upon any such elevator hereafter constructed, and no such elevator hereafter constructed shall be permitted to run until the inspection herein provided for has been made and a certificate issued by the Commissioner of Buildings or such inspector that the same has been inspected, and the certificate shall be posted in a conspicuous place in such elevator. Every passenger or freight elevator now in operation within the city shall be provided with some efficient device to procure the safe operation of such passenger or freight elevator in its running up and down, and such device shall be subjected to the same test as is herein provided for elevators to be hereafter constructed, and a certificate of such inspection issued as provided for elevators to be hereafter constructed, and every such elevator now in operation within the city, or which may hereafter be constructed and operated in the city, shall be inspected under and by authority of the Commissioner of Buildings at least once every six months. Every owner or agent of any building who fails to comply with any provision of this section shall be fined not less than fifty dollars nor more than two hundred dollars for each offense, and every owner or agent of any building wherein any passenger or freight elevators are situated in the city who refuses to permit the inspection of any such elevator or who refuses to permit the making of the test in this section provided, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator runs or is operated on and after the date of the refusal to permit inspection of such elevator or the refusal to allow such test to be made.

1076-7—658-9

Sec. 1078. **(Safety Devices.—Further.)**—Every passenger or freight elevator now running or operating within the city, or which may hereafter be constructed and run and operated, shall be provided with some efficient device for the purpose of preventing the cab or car of such elevator from falling, or the securing of the safety of the cab or car and its load, in case it does fall, and all such devices that are applied to such passenger or freight elevator for the purpose of preventing such cab or car from falling or for stopping it in case it does fall shall be subjected to a practical test, such test to be made under the supervision of the Commissioner of Buildings, to determine the efficiency of such device and to secure the safety of the cab or car and its contents. Every person, whether owner or agent of any building wherein any such passenger or freight elevator within the city is now run or operated, or which may hereafter be constructed or operated, who shall fail or neglect to provide such passenger or freight elevator with such device for the purpose of preventing the cab or car from falling, or the securing of the safety of the cab or car in case it does fall, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator is run or operated without being provided with such device.

Sec. 1079. **(Tests.—Owner Must Permit.)**—Any owner or agent of any building wherein any passenger or freight elevator is run or operated within the city who desires to have a test made by and under the authority of the Commissioner of Buildings as to whether such elevator is provided with sufficient and proper safety devices shall or may notify said Commissioner of Buildings in writing that such a test is desired; and the time when such test may be made, which shall not be less than two nor more than ten days after such notice is given to the Commissioner of Buildings; and it shall be the duty of every owner or agent of any such building wherein any such passenger or freight elevator is run or operated in the city, or which may hereafter be constructed and operated, to permit the making of the test of such devices upon demand being made by the Commissioner of Buildings or by a duly authorized inspector, and every owner or agent of any such building wherein any such passenger or freight elevator is run or operated, or which may be hereafter constructed and operated, who refuses to permit the test of such devices to be made upon demand of said Commissioner of Buildings or Elevator Inspector, within five days from and after such demand is made, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such passenger or freight elevator is run or operated after such demand for and refusal of the making of such test.

Sec. 1080. **(Certificate to Be Furnished and Posted.)**—Whenever any such elevator shall have been inspected and the tests herein required shall have been made of all safety devices with which such elevator is required to be equipped, if the result of such inspection and tests shall show such elevator to be in good condition, satisfactory to the Commissioner of Buildings or the Inspector of Elevators, and that such safety devices have been provided, in accordance with the requirements of this chapter, and are in good working condition and in good repair, it shall be the duty of the Commissioner of Buildings or Inspector of Elevators to issue or cause to be issued, upon the payment of the inspection fee required by the provisions of this chapter, a certificate setting forth the result of such inspection and tests, and whether such elevator and its equipment is in safe condition and in good working order. Such certificates shall be furnished to the owner or agent of the building wherein such elevator is operated, and shall be posted by such owner or agent in a conspicuous place in such elevator.

If the result of such inspection or tests shall show such elevator not to be in safe condition or not to be in a condition of good repair, or shall show that such devices, or any of them, have not been furnished, or, if furnished, are not in good working order or in a good condition of repair, such certificate shall not be issued until such elevator and its equipment or such safety device or devices shall have been put in good working order and in a good condition of repair, satisfactory to the Commissioner of Buildings or the Inspector of Elevators.

In any event, however, the inspection fees herein required shall be paid either at the time application is made for inspection or upon the completion of such inspection and tests.

Sec. 1081. **(Tests to Be Made Semi-annually.)**—It shall be the duty of the Commissioner of Buildings to cause the tests to be made as provided for in Sections 1077, 1078 and 1079 of this ordinance of each passenger and freight elevator in the city at least once in every six months from and after the issuance of the first certificate.

1078 to 1081—660 to 663

Sec. 1082. (Inspectors.—Duties of.)—Whenever any inspector of any passenger or freight elevator finds any of the running parts or automatic devices, or other equipment out of order or in an unsafe condition he shall immediately report the same to the Commissioner of Buildings, together with a statement of all the facts relating to the condition of such elevator or elevators.

Sec. 1083. (Power to Shut Down Elevators.)—It shall be the duty of the Commissioner of Buildings, upon receiving a report from any inspector of the unsafe condition of any elevator, to order and cause such elevator to be stopped from use until the same shall have been placed in a safe condition, and any owner or agent of any building wherein any such passenger or freight elevator is run or operated within the city who permits or allows any such elevator to run after the receipt of a notice, in writing, from the Commissioner of Buildings that any such elevator is out of order, or is in an unsafe condition, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each and every day on which such elevator is run or operated without being put in a safe condition or placed in good order.

Sec. 1084. (Device.—Efficient.—To Be Approved.)—Any device which shall prove efficient for the purposes hereinbefore described in this chapter shall be approved by the Commissioner of Buildings, if, after a test by said Commissioner or any of his Elevator Inspectors, it is found that such device or devices satisfactorily performs the work it is intended should be performed by such device or devices in and by the provisions of this chapter.

Sec. 1085. (Inspections to Be Made at the Same Time.—One Fee.)—All certificates for and inspections of hoistways and elevators provided for in this article shall be made at the same time and the fee required to be paid by Section 1087 of this ordinance shall include the cost of all such inspections and issuance of such certificates.

Sec. 1086. (Elevators Not Required to Be Equipped with Safety Devices.)—The provisions of this chapter requiring the equipment of elevators with safety devices shall not apply to any elevator or elevators in any private residence not more than three stories in height, nor to any hand hoists, elevator or hoist used solely for hoisting materials or tools in any building in course of construction.

For the purposes of this section, flat or apartment buildings shall not be held to be private residences, and any elevator or elevators operated in such flat or apartment buildings shall be equipped with safety devices in accordance with the provisions of this chapter.

Sec. 1087. (Inspections.—Fees.)—The owners, agents or occupants of any building in which an elevator is used shall pay to the City Collector, before a certificate of inspection is issued, a fee of two dollars for each inspection of each elevator made in pursuance of the provisions of this ordinance.

Sec. 1088. (Certificates of Inspection.—Construction.—Details of.)—When an inspector finds a hoistway, door, shaft and elevator and its equipment, including safety devices, in a sound and safe condition, he shall make and deliver to the owner, or to his agent, a certificate signed by the Commissioner, which shall contain the date of inspection, the condition of the elevator at that date, the weight it may safely carry, and a statement that the shaft, doors and all equipments, including safety devices, are constructed in a safe and proper manner and are constructed in accordance with the provisions of this chapter, which certificate shall be by the owner of the elevator framed and put in some conspicuous place in such elevator for examination by the public; provided, that the words "safe condition" in this section shall mean that it is safe for any load up to the amount of weight named in such certificate.

Sec. 1089. (Hatch.—Doors.—Freight Elevators.)—It shall be lawful for elevators used exclusively as freight elevators to be without inclosing walls, but in all such cases there shall be at every floor through which such freight elevators pass automatic hatch closers or automatic doors, made in such manner that they will fully close each well hole when the temperature in such well hole exceeds one hundred and forty degrees Fahrenheit; and it shall be the duty of the owner, agent or person in possession, charge or control of the building in which such elevator or elevators is or are maintained to keep such hatch closers or doors at all times in good working order, and any such owner, agent or person failing to do so shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense.

Before any doors shall be considered as complying with the provisions of this section they shall be examined by the Commissioner of Buildings and the Fire Marshal, and if it be found by such officials that such doors will automatically close when the temperature at or near the same exceeds one hundred and forty degrees Fahrenheit, and that also the conditions of construction and operation of such doors or hatch closers are such that there is no reasonable probability of their getting out of order

and failing to operate when required, and if there is nothing in their construction or operation that is likely to cause accidents to or interference with the elevator service in the hatch holes which they are intended to close, then, and in such case only, shall the use of such hatch closers or doors be permitted.

But such automatic hatch closers or doors shall only be permitted in cases where the building in which such freight elevator is in use shall be equipped with stairways, or stairways and passenger elevators, sufficient to afford ample means of escape from such building in case of fire for all persons employed or for all persons in such building, and in buildings not so equipped such freight elevators shall be inclosed in fireproof walls, as hereinafter required.

Provided, that all freight elevators herein specified shall be either inclosed in fireproof walls, as hereinafter required, or equipped with automatic hatch closers or doors, as herein specified; and provided, further, that this section shall not apply to elevators in fireproof buildings.

Sec. 1090. (Passenger and Freight Elevators.—Inclosure of.)—In all non-fireproof buildings all passenger elevators and all freight elevators, except such as are expressly excepted by this chapter, shall be inclosed in a wall of brick, tile or such other incombustible material as may, from time to time, be approved by the Commissioner of Buildings as proper and suitable for the purpose; such wall to extend from the foundation to the roof of such building, and when built of brick or tile to be entirely self-sustaining; provided, that where such elevator shafts are placed within walls or partitions of fireproof material surrounding such shafts in common with stairways, or in common with stairways and corridors, additional inclosures about such shafts alone shall not be required. Provided, further, however, that the provisions of this section shall not apply to any non-fireproof building which is equipped throughout on every floor and in every room thereof and in all stairways, platforms, elevator shafts, elevator hoistways and well holes with an automatic sprinkler system approved by the Fire Marshal.

Sec. 1091. (Doors.—On Elevators.)—In all elevator shafts which are herein required to be inclosed with fireproof walls, the openings through which ingress and egress to and from such elevators is had, shall be equipped with fireproof doors, of iron or other incombustible material, to be approved by the Building Commissioner, which shall be made to open from the inside, except that they shall also be made to open from the outside by means of a key or other device satisfactory to the said Commissioner.

Sec. 1092. (Skylights.—Over Elevators.—Windows.)—The roof of each such passenger elevator, shaft or inclosure shall be formed by a skylight, and passenger elevators shall have a ventilator of at least one-twentieth of the area of the shaft, which shall have an operating device which shall be operative from every floor. Skylights may be omitted in shafts wherein there are windows opening on streets, alleys or courts or other vacant spaces, which will permit sufficient light and air, but such windows shall be glazed with fire-resisting glass.

The foregoing provisions relating to elevators and hoistways shall apply to buildings now existing or hereafter constructed.

Sec. 1093. (Safety of Employes.—Provisions For.)—In every factory, workshop, or other place or structure where machinery is employed, the belting, shafting, gearing, elevators and every other portion of machinery, when so located as to endanger the lives and limbs of those employed therein while in the discharge of their duties, shall be, as far as possible, so covered or guarded as to make them reasonably safe and to prevent injury to such employes.

ARTICLE XIX.

FIRE ESCAPES AND STANDPIPES.

Sec. 1094. (Buildings Required to Have Fire Escapes and Standpipes.—Inspection.—Fee.)—All buildings of four or more stories in height, in the city, except buildings used exclusively for private residences having two flights of stairs leading from the ground floor to the top floor of the building, shall be provided and equipped with one or more metallic standpipes and ladders combined, or stair fire escapes, as described in Section 1102 of this chapter, with wrought-iron or steel balconies, with suitable railings at each floor, and firmly secured to the outer walls, and in such locations and numbers as shall be satisfactory to the Commissioner of Buildings, the Fire Marshal and the fire-escape inspector.

All such fire escapes shall be put up and completed to conform to the buildings for which they are respectively intended, and shall be inspected after completion, and

if found in a perfectly safe and satisfactory condition, a certificate shall be issued by the Commissioner of Buildings to that effect, to the owner, agent or occupant of any such building, upon payment to the city collector of a fee of one dollar.

Sec. 1095. **(Specifications for Ladder Fire Escapes.—Anchors.)**—All single and double fire escapes, with ladders, hereafter erected, shall be in strict accordance with the following specifications:

There shall be no less than three one-inch square wrought-iron anchors to every six-foot balcony, and six for a twelve-foot balcony. Such anchors shall pass through the wall of building and bolt on the inside with a three-fourths by two inch nut and three and one-half inch iron washer back of nut, where the wall is not over twenty inches thick; but where wall is over twenty inches thick, anchors shall be inserted at least eight inches into the wall on an angle of thirty-five degrees.

The brace of anchors shall at least be twenty inches spread, and pass into the wall four inches at bottom. No other form of anchors shall be allowed without a special permit from the Commissioner of Buildings.

Sec. 1096. **(Balconies.)**—All balconies hereafter erected shall be either steel or wrought iron, capable of sustaining a weight of five hundred pounds to the square foot. The balcony frame shall be made of not less than one and one-half by three inch angle iron, securely riveted together, with crossbars every two feet, such bars to be punched one-half inch square every two inches center, and one-half inch square iron forced through the same, leaving a manhole of not less than twenty-four by twenty-four inches. The crossbars shall be secureiy riveted to the angle iron frame. The crossbars for a balcony twenty-eight inches wide shall be one and one-half by three-eighths inch iron. Balcony frames over twenty-eight inches wide shall be made of not less than two by three-eighths inch iron to conform with the increased dimensions of iron in crossbars; for thirty-inch balcony, two by three-eighths inch; for thirty-six inch balcony or over, two and one-half by three-eighths inch. All balconies over this width shall have a two-inch "T" iron through the center of balcony for the bars to rest upon. Such balconies shall have a substantial cast or wrought iron post every three feet, bolted to the balcony. No balcony shall have less than two guard rails, which shall be of wrought iron, or new pipe not less than three-fourths inch in diameter, and the ends shall be anchored in the wall of building not less than ten inches on an angle of thirty-five degrees.

Sec. 1097. **(Ladders.)**—The ladder, where used in combination with the standpipe, shall be bolted to such standpipe with short tapped bolts every four feet and bolted to the balconies. Rungs of ladder to be one-half inch square iron, with the corners upward, so as to give a safe footing. Every other run shall be riveted and shall be fourteen-inch centers. Where ladder is put up without a standpipe, the side guards shall be two by three-eighths inch flat iron or one and one-fourth inch pipe. All ladders shall be seventeen inches or more between pipes. No second-hand pipe shall be used.

Sec. 1098. **(Standpipes Outside Buildings.)**—The standpipe shall be of the best three-inch wrought iron, seven and one-half pounds to the foot, and a two and one-half inch brass hose valve, of the city standard thread, shall be attached to the standpipe at every outlet at each floor and on the roof.

Sec. 1099. **(Standpipes Inside Buildings.—Hotels and Lodging Houses Over Three Stories to Have.—Location and Maintenance of, Subject to Approval by Fire Marshal.—Penalty.)**—Inside of every building of any of the classes hereinbefore defined which is over one hundred feet in height and inside every building over three stories in height which is occupied exclusively or chiefly for hotel or lodging-house purposes, there shall be one four-inch standpipe, extending from pump to roof, also connection on first floor, with two-way Siamese connection for fire department and check valve against pump; one hose connection on each floor and roof, with fire department thread and enough hose attached to reach any point of the floor; such hose shall be subject to the approval of the Fire Marshal. Each such standpipe shall be located and maintained to the satisfaction and approval of the Fire Marshal and shall at all times be connected either with a pump or with a tank upon the roof of such building, in such a manner as to be capable of furnishing a good stream of water sufficient for the use of the fire department and at a pressure of not less than fifty pounds to the square inch. The owner, agent, occupant or person in possession, charge or control of any such building herein required by the provisions of this section to be equipped with a standpipe who shall refuse, neglect or fail to have such standpipe so connected as to be at all times ready and capable of furnishing a stream of water at a pressure of not less than fifty pounds to the square inch, shall be fined not less than fifty dollars nor more than two hundred dollars for each offense.

1095 to 1099—676 to 680

Sec. 1100. (Siamese.)—There shall be a two-way automatic siamese at the bottom of each standpipe, so that two steam fire engines may be attached to it without interfering with each other. Such siamese shall be within easy reaching distance from the sidewalk and be securely anchored to the wall of the building.

Sec. 1101. (Anchors for Top of Standpipe.—Painting.)—All the anchors for the top of standpipe and ladders shall pass through the wall and bolt on the inside of same.

All work shall be painted with two coats of the best mineral paint, and all holes shall be filled up with the best cement.

Sec. 1102. (Stairway Fire Escapes.—Erection of.—Location.—Component Parts.)—The Commissioner of Buildings or fire escape inspector shall determine upon the location of all stair fire escapes before erection of same is commenced.

A permit shall be obtained from the Department of Buildings before work is commenced, which permit will be issued on payment to the city collector of a fee of two ($2) dollars.

No permit for a stairway fire escape projecting three feet or more from the face of the wall shall be granted unless a detailed plan for the fire escape, approved by a licensed architect or practicing structural engineer, is submitted to the Commissioner of Buildings, and a copy of such plans shall be left on file with said commissioner.

(Anchors.)—All anchors for stairway fire escapes shall, wherever possible, pass through the wall of building and be secured on inside of same. Where it is impossible to anchor through walls, anchors shall be put in wall not less than fifteen inches at an angle of thirty-five degrees. On buildings of steel construction, where walls are less than twenty inches in thickness, there shall be steel channels at least four inches wide set on inside of building from column to column and bolted or riveted to columns, and anchors shall be bolted on inside of channels.

Anchors for a platform four feet two inches or less in width shall be made of one-inch square iron; over four feet two inches and not over six feet, shall be one and one-fourth inch square iron, with brace; over six feet, shall be one and one-half inch square iron, with brace. All anchors shall be turned up not less than six inches at the outside of platform to bolt post to.

(Braces.)—Braces shall be the same thickness as the anchors. Spread of braces shall be the width of platform. Where the platforms are over five feet in width, anchors shall have double braces, one to the outside and one to the center of platform.

(Platforms.)—Platforms shall be not less than fifty inches wide at ends; passageways shall be not less than twenty-four inches between building and railings. Platforms shall be not less than twelve feet in length. The frames and crossbars shall be made as specified by Section 1096 of this chapter. Platforms shall have clips at each end bolted to anchors. No door or window or shutter shall open so as to obstruct in any way the free passage on or along a platform or a staircase or ladder fire escape.

(Stairs.)—All fire escape stairs for apartment buildings, hotels, boarding houses, factories and office buildings, where there are less than one hundred people, shall be not less than two feet wide between railings and stringers. Where there are more than one hundred people, stairs shall be three feet wide. All stairs for halls, churches, theaters, hospitals, schools, department stores and buildings where large numbers of people congregate shall be not less than three feet wide in the clear, and all passageways shall be not less than three feet wide in the clear; stringers shall be made of two bars three by five-sixteenths inch, about one inch apart, or four and one-half by three-eighths inch flat iron. Where over twelve feet in length, they shall have anchor and brace in center. The treads shall be made of one-half inch square steel or iron, corner upward not to exceed one and five-eighths inches center, riveted at ends to two by five-sixteenths inch flat iron or steel. There shall be not less than four bars to a tread, where treads are less than twenty-seven inches in length; where treads are over twenty-seven inches in length, there shall be not less than six bars to a tread; then, there shall be a truss supporting treads made of bar iron two inches by three-eighths of an inch, riveted to bars of treads in center, supported by two seven-sixteenth inch rods bolted at each end of treads. All stairs shall have an incline of about forty-five degrees; rise of treads shall be not less than seven inches and not more than ten inches.

(Railings.)—All stairs shall have three bar railings made of one-inch bar iron for top rail and three-quarter inch bar iron for lower rail, and when such stairs are more than three inches from wall of building, then there shall be one or more hand rails on the wall side of such stairs.

(Posts.)—All posts used for stair fire escapes shall be made of one and one-half inch angle or channel iron not less than three feet six inches high, and shall have braces on outside turned upward and fastened to frame of balcony or stairs and not less than half way up the post; all stair fire escapes shall extend to the ground, either

by counterbalance or drop stairs. Cable for counterbalance stairs shall be not less than three-quarters inch in size, and shall be well oiled or greased when hung up, and oiled or greased at least once a year. All pulleys and cables holding counterbalance shall be covered at bracket, so as to protect it from snow or ice.

(Painting.)—All stair fire escapes shall be painted with two coats of paint, one at the shop and one after completion at the building.

Where it is impossible to erect stair fire escapes according to these specifications, then plans shall be submitted to the Commissioner of Buildings or fire escape inspector for approval.

All such fire escapes shall, on completion, be inspected by the fire escape inspector, and if found safe and satisfactory, a certificate will be issued upon payment of one ($1) dollar to the city collector.

Sec. 1103. (Fire Escapes in General.)—No fire escape of any kind shall be constructed except upon a permit therefor issued by the Commissioner of Buildings upon the payment by the applicant therefor to the city collector of a permit fee of two dollars.

Every building in the city required by law to be equipped with metallic standpipes and wrought iron or steel balconies, or other fire escape devices, shall have displayed in conspicuous places, on each floor of such building, notices sufficient in number and in plainly legible type at least six inches in height, indicating and showing the location of such metallic ladders, balconies and fire escapes and the easiest way to reach them. If such notices be not displayed within thirty days after such equipment and kept continuously displayed, said commissioner is authorized to take such action as may be necessary to have such building closed.

Sec. 1104. (Penalty.)—Any owner, agent or person in possession, charge or control of any such building, who violates, disobeys, omits or neglects to comply with the terms of the foregoing section, shall be fined not less than five dollars nor more than fifty dollars for each offense, and every such owner, agent or person shall be deemed guilty of a separate offense for every day such violation, disobedience, omission or neglect shall continue, and shall be subject to the penalty imposed hereby for each and every such separate offense.

Where stair fire escapes pass windows or doors, the windows or doors shall be of fire-resisting glass and have metal frames and sash, or such fire escapes shall be hooded with metal for at least two feet each side of such opening.

ARTICLE XX.

FIRE LIMITS.

Sec. 1105. (Fire Limits of City.)—The fire limits of the City of Chicago shall be and are hereby defined as follows: All that part of the City of Chicago bounded by the following limits: Commencing at the intersection of the shore of Lake Michigan and a line one hundred and fifty feet north of the center line of Belmont Avenue, thence west on said first mentioned line to the center line of North Halsted street, thence south along said center line of North Halsted street to the center line of Fullerton avenue, thence west along said center line of Fullerton avenue to the center of the north branch of the Chicago river, thence northwesterly along the center of said north branch of the river to the center line of Belmont avenue, thence west along said center line of Belmont avenue to the center line of Kedzie avenue, thence south along said center line of Kedzie avenue to the center line of West North avenue, thence west along the center line of West North avenue to the center line of North Fortieth avenue, thence south along said center line of North Fortieth avenue to the center line of the first alley north of Park avenue, thence west along the center line of said alley to the center line of South Forty-sixth avenue, thence south along said center line of South Forty-sixth avenue to the center line of West Madison street, thence west along the center line of West Madison street to the center line of South Forty-eighth avenue, thence north along said center line of South Forty-eighth avenue to the center line of Kinzie street, thence west along said center line of Kinzie street to the center line of South Fifty-second avenue, thence south along said center line of South Fifty-second avenue to the center line of West Madison street, thence east along said center line of West Madison street to the center line of South Forty-eighth avenue, thence south along said center line of South Forty-eighth avenue to the center line of West Jackson street, thence east along said center line of West Jackson street to the center line of South Forty-sixth avenue, thence south along said center line of South Forty-sixth avenue to the center line of West Harrison street, thence west along said center line of West Harrison street to the center line of South Forty-

eighth avenue, thence south along said center line of South Forty-eighth avenue to the center line of West Twelfth street, thence east along said center line of West Twelfth street to the center line of South Forty-sixth avenue, thence south along said center line of South Forty-sixth avenue to the center line of West Twenty-second street, thence east along said center line of West Twenty-second street to the center line of South Fortieth avenue, thence south along said center line of South Fortieth avenue to the center line of the Illinois and Michigan canal, thence northeasterly along the center line of said canal to the center line of South Western avenue, thence south along said center line of South Western avenue to the center line of West Thirty-ninth street, thence east along said center line of West Thirty-ninth street to the center line of State street, thence south along said center line of State street to the north line of West Forty-seventh street, thence west along said north line of West Forty-seventh street to a line seventy-five feet west of the west line of South Halsted street, thence south along said line seventy-five feet west of the west line of South Halsted street to a line seventy-five feet north of the north line of West Sixty-third street, thence west along said line seventy-five feet north of the north line of West Sixty-third street to the center line of South Ashland avenue, thence south along the center line of South Ashland avenue to the center line of West Sixty-third street, thence east along said center line of West Sixty-third street to the center line of State street, thence south along said center line of State street to the center line of East Seventy-fifth street, thence east along said center line of East Seventy-fifth street to the shore of Lake Michigan, thence northerly and northwesterly along the shore of Lake Michigan to the place of beginning.

Also commencing at a point in the center of Manistee avenue where it intersects the right of way of the main line of the Lake Shore and Michigan Southern railroad; thence northeasterly and north along the center line of Manistee avenue to the center line of Eighty-ninth street, thence east along the center line of Eighty-ninth street to the center line of Mackinaw avenue, thence south along the center line of Mackinaw avenue to the center line of Harbor avenue, thence southwesterly along the center line of Harbor avenue and Harbor avenue extended to the northeasterly line of said Lake Shore and Michigan Southern railroad, thence northwesterly along the northeasterly line of said right of way to the place of beginning.

Sec. 1106. (**Fire Limits.—Provisional.**)—Provided, however, that any person desiring to erect a frame or wooden building, to be used for residence or mercantile purposes within that portion of the territory bounded on the east, between Sixty-seventh and Seventy-fifth streets, by Lake Michigan, on the south by the center line of Seventy-fifth street, on the west by the center line of State street to the intersection of Sixty-third street, thence east along the center line of Sixty-third street to the intersection of Cottage Grove avenue, thence south along the center line of Cottage Grove avenue to the intersection of Sixty-seventh street, thence east along the center line of Sixty-seventh street to Lake Michigan, shall have a right to do so, upon presenting a petition to the Commissioner of Buildings, together with a plat, plans and specifications showing the place where such building is to be erected. Such petition shall be verified by the affidavit of the applicant and shall contain the written consent of the owners of a majority of the frontage upon each side of the streets or alleys in the block or square in which the building is to be erected.

No frame or wooden residence or mercantile building shall be erected within the said provisional fire limits exceeding forty feet in height unless the basement story shall be constructed of brick or stone, in which case the height shall not exceed forty-five feet above the sidewalk.

Sec. 1107. (**Fire Limits.—Exception From.**)—There shall be excepted from the fire limits as hereinbefore defined, the territory bounded as follows:

Commencing at the intersection of a line seventy-five feet west of the west line of State street and a line seventy-five feet south of the south line of Forty-seventh street, thence west along said line seventy-five feet south of the south line of Forty-seventh street to a line seventy-five feet east of the east line of Wentworth avenue, thence south along said line seventy-five feet east of the east line of Wentworth avenue to a line seventy-five feet north of the north line of Sixty-third street to a line seventy-five feet west of the west line of State street, thence north along said line seventy-five feet west of the west line of State street to the place of beginning.

Also that territory within the lines beginning at the intersection of a line seventy-five feet west of the west line of Wentworth avenue and a line seventy-five feet south of the south line of Forty-seventh street, thence west along said line seventy-five feet south of the south line of Forty-seventh street to a line seventy-five feet east of the east line of South Halsted street, thence south along said line seventy-five feet east of the east line of South Halsted street to a line seventy-five feet north of the

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north line of Sixty-third street, thence east along said line seventy-five feet north of the north line of Sixty-third street to the center line of Princeton avenue, thence north along said center line of Princeton avenue to the center line of Sixty-first street to a line seventy-five feet west of the west line of Wentworth avenue, thence north along said line seventy-five feet west of the west line of Wentworth avenue to the place of beginning.

ARTICLE XXI.

FRONTAGE CONSENTS.

Sec. 1108. **(Definition of Word "Block," as Used in This Chapter.)**—Whenever in this chapter a provision is made that frontage consents shall be obtained for the erection, construction, alteration, enlargement or maintenance of any building or structure in any block, the word "block," so used, shall not be held to mean a square, but shall be held to embrace only that part of a street bounding the square which lies between the two nearest intersecting streets, one on either side of the point at which such building or structure is to be erected, constructed, altered, enlarged or maintained, unless it shall be otherwise specifically provided.

Sec. 1109. **(Hospitals.—Permits.—Special Consents.—Height Of.)**—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage in any block, if two-thirds of the buildings fronting upon both sides of the streets bounding such block or square are devoted exclusively to residence purposes, any hospital for the care, treatment or nursing of three or more insane persons; or any hospital for the care, treatment or nursing of three or more inebriates, or persons suffering from the effects of the excessive use of alcoholic liquors; or any hospital for the care, treatment or nursing of three or more epileptics; or any hospital for the care, treatment or nursing of three or more persons addicted to, or suffering from, the excessive use of morphine, cocaine or other similar drugs or narcotics; or any hospital for the care, treatment or nursing of any person or persons affected with any infectious or contagious disease, unless the owners of a majority of the frontage in such block and in addition thereto the owners of a majority of the frontage on the opposite sides of the streets bounding such block consent in writing to the building, constructing or maintaining, managing or conducting of any such hospital in such block. Such written consents of the majorities of such property owners shall be filed with the Commissioner of Buildings, and an exact copy of same shall be filed with the Commissioner of Health before a permit shall be granted for the building or constructing or a license issued for the maintaining, conducting or managing of any such hospital. Provided, that any such building that may be used for such purposes as set forth in this section and which is over two stories in height shall be of fireproof construction throughout, and no hospital shall be built to exceed six stories in height.

Sec. 1110. **(Hospitals Near Schoolhouses.—Location Of.)**—No hospital of any kind or description hereafter erected or established shall be erected or established within four hundred feet of any property used for school purposes.

Sec. 1111. **(Stables.—Gas Reservoirs.—Blacksmith Shops.—Foundries.—Packing Houses.—Rendering Plants.—Soap Factories.—Tanneries.—Breweries.—Distilleries.—Grain Elevators.—Junk Shops.—Laundries.—Special Consents Necessary.)**—It shall not be lawful for any person or corporation to locate, build, construct or maintain, on any street or alley in the city, in any block in which two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, any building for a boarding, livery or sale stable, gas reservoir, blacksmith shop, foundry, packing house, rendering plant, soap factory, tannery, brewery or distillery, grain elevator, junk shop, or laundry to be run by machinery, without the written consent of a majority of the property owners, according to frontage, on both sides of such street or alley.

Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction of any such building. Provided, that in determining whether two-thirds of the buildings on both sides of the street are used exclusively for residence purposes any building fronting upon another street and located upon a corner lot shall not be considered.

Sec. 1112. **(Reformatories.—Sheltering Institutions.)**—It shall be unlawful for any person or corporation to build, construct, maintain, conduct or manage any reformatory, rescue or sheltering institution in any block or square in which two-thirds of the buildings on both sides of the street or streets on which the proposed reformatory, rescue or sheltering institution may front are used exclusively for residence purposes, without the written consent of a majority of the property owners, according to frontage, on both sides of the streets bounding such block.

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Such written consent shall be obtained and filed with the Commissioner of Buildings before a permit is issued for the construction or keeping of such building.

Provided, that in determining whether two-thirds of the buildings on both sides of the street are used exclusively for residence purposes, any building fronting upon another street and located upon a corner lot shall not be considered.

Sec. 1113. **(Permits for Moving Frame Buildings.—Requirements.—Written Consents Must Be Obtained.—Affidavits Made.)**—Permits to move frame buildings shall be granted, if any such frame building has not been damaged to an extent greater than fifty per cent of its original cost, by fire, wear and tear, the action of the elements or otherwise. Any person desiring to remove a frame building shall first obtain the written consent to such removal from persons owning a majority of the frontage of the lots in the same block or square in which it is proposed to locate such removed building, and also the consent of the persons owning a majority of the frontage of the lots opposite and nearest to the proposed location and within one hundred and fifty feet of the same.

This section shall not apply to the case of any person removing a building upon his own premises and not going upon the premises of any other person, or upon any street, alley or other public place, in making such removal.

Provided, however, that no permit shall be issued for the removal of any frame building from any point outside the fire limits to any point within the fire limits, when such building is of such a character that it would not be lawful to build it within the fire limits.

ARTICLE XXII.

USE AND OBSTRUCTION OF STREETS FOR BUILDING PURPOSES.

Sec. 1114. **(Sidewalk and Street.—Occupation Of.—Limitations.)**—The extent of occupation of sidewalk and street to be covered by the terms of a permit for street obstruction or building shall be as follows:

Such permit shall not authorize the occupation of any sidewalk or street or part thereof other than that immediately in front of the lot or lots upon which any building is in process of erection and in relation to which such permit is issued.

During the progress of building operations a sidewalk not less than four (4) feet in width shall be at all times kept open and unobstructed for the purpose of passage in front of such lot or lots. Such sidewalk shall, if there are excavations on either side of the same, be protected by substantial railings which shall be built and maintained thereon so long as such excavations continue to exist. It is not intended hereby to prohibit the maintenance of a driveway for the delivery of material across such sidewalk from the curb line to the building site.

Sec. 1115. **(Sidewalks.—Delivery of Material.—Elevated Sidewalks.)**—It shall be permitted for the purposes of delivering material to the basements of buildings in process of erection to erect elevated temporary sidewalks to a height of not exceeding four feet above the curb level of the street; and in case a sidewalk is so elevated, it shall be provided with good, substantial steps or easy inclines on both ends of the same and shall have railings on both sides thereof.

Sec. 1116. **(Sidewalks.—Temporary Roof Over.—Time Maintained.)**—If the building to be erected is more than four stories in height, and is set at or near the street line, there shall be built over the adjoining sidewalk a roof having a framework and covering composed of supports and stringers of three by twelve timbers, not more than four feet from centers, covered by two layers of two-inch plank.

Such roof shall be maintained as long as material is being used or handled on such street front and above the level of such sidewalk.

In all cases such temporary sidewalks and their railings and approaches, and the roofs over the same, shall be made, as regards ease of approach, strength and safety, to the satisfaction of the Commissioner of Buildings.

Sec. 1117. **(Street.—Storage of Building Materials.—Limitations.)**—The occupation of the street for the storage of building materials, or for temporary sidewalks, shall never exceed, in front of any one building, one-third of the width of the roadway of the same, and in no event shall any material be stored or placed within four feet of any street or steam railway track.

Sec. 1118. **(Sidewalks and Street.—Excavated Material and Rubbish On.—How Cared For.)**—Earth, other than sand to be used in the construction of the building, taken from excavations, and rubbish taken from buildings shall not be stored either upon sidewalks or roadways of streets, and shall be removed therefrom from day to day as rapidly as produced. When dry rubbish, apt to produce dust, is being handled, it shall be kept wetted down so as to prevent its being blown about by the wind.

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Sec. 1119. (Derricks.—Limitations.)—For all buildings more than four stories in height, the use of derricks set upon the sidewalk or street is prohibited. In no case shall the guy lines be less than fifteen feet above the roadbed.

Sec. 1120. (Frontage Adjacent.—How Occupied for Building Purposes.)—If the written consent and a waiver of claims for damages against the city of the owners of properties abutting upon the site of any proposed building is first obtained and filed with the Commissioner of Public Works, the permission to occupy the roadway and the sidewalk may be extended beyond the limits of such building in front of the property for which the consent of the owner or lessee thereof has been secured, upon the same terms and conditions as those herein fixed for the occupation of sidewalk and street in front of the building site.

Sec. 1121. (Street, Use of, for Building Purposes.—When Terminated.)—Streets and sidewalks may be occupied for the purposes of building only in connection with the actual erection, repair, alteration or removal of buildings, and permission for such occupancy shall terminate with the completion of such operation. It shall be unlawful to occupy any sidewalk or street after the completion of the operation for which a permit has been issued by the Department of Buildings. It shall also be unlawful to occupy a sidewalk or street, under authority of such permit, for the storage of articles not intended for immediate use in connection with the operations for which such permit has been issued.

Sec. 1122. (Red Lights.)—Red lanterns shall be displayed and maintained during the whole of every night at each end of every pile of material in any street or alley and at each end of every excavation.

Sec. 1123. (Street Obstructions.—Permits.—Bonds.—Fees.)—Permits for the obstruction of streets shall be issued by the Commissioner of Public Works and shall be paid for, in proportion to the street frontage occupied, at the rate of two dollars per month for each twenty-five feet of frontage so occupied.

No permit shall be issued until the applicant therefor shall have executed and filed with the Commissioner of Public Works a bond, with sureties to be approved by said Commissioner, and in an amount to be designated by him (in no case to be less than ten thousand dollars), conditioned to indemnify, save and keep harmless the city from any and all loss, cost, expense or liability of any kind whatsoever which it, the city, may suffer or be put to or which may be recovered from it from or by reason of the issuance of such permit, or by reason of any act or thing done under or by virtue of the authority given in such permit.

ARTICLE XXIII.

BILLBOARDS AND SIGNS.

Sec. 1124. (Billboards or Signs on Buildings.)—Every billboard or sign of greater height than two feet and placed on any building above the level of the ground shall be made wholly of incombustible material and shall be securely anchored and fastened in a manner satisfactory to and approved by the Commissioner of Buildings.

No billboard or sign anchored to, fastened to or situated above or upon the roof of any building shall be constructed so that the bottom of such billboard or sign shall be less than one foot or more than six feet above the surface of such roof, and no such billboard or sign shall exceed eight feet in height or be more than one hundred square feet in superficial area.

No billboard or sign such as is described in this section, whether anchored to or fastened to any building, or situated or located upon the roof thereof, shall be constructed or put in place unless in accordance with plans and specifications which have been submitted to and approved by the Commissioner of Buildings.

Billboards or signs made of incombustible material attached to buildings shall not be of greater height than two feet, and shall be erected, constructed and maintained in a manner satisfactory to and approved by the Commissioner of Buildings.

Sec. 1125. (Size.—Construction.—Exception.)—All signs or billboards other than those painted on or erected upon any building shall be limited in their superficial area to one hundred square feet, and shall be constructed of sheet or galvanized iron or some equally incombustible material, and such signs or billboards shall not be located nearer than twenty-five feet back of the front line of the lot whereon the same are to be erected. All such signs or billboards shall be securely anchored or fastened so as to be safe and substantial.

Sec. 1126. (Height and Distance from Ground.)—No such sign or billboard shall be constructed at a greater height than ten feet above the level of adjoining streets, and the base of the sign or billboard shall be in all cases at least three feet above the level of the adjoining streets. In case the grade of adjoining streets has

not been established, no sign or billboard shall be constructed at a greater height than ten feet above the surface of the ground.

Sec. 1127. (Wooden Billboards or Signs.—Construction.—Size.)—Billboards or signs not exceeding twelve square feet in area may be built of wood or other combustible material, and such signs shall be exempted from the provisions of this article.

Sec. 1128. (No Billboard or Sign to Be Erected Without Permit.)—No billboard or sign such as is described in this article shall be erected, constructed or maintained within the city unless a permit shall first have been secured by the person desiring to erect, construct or maintain such billboard or sign, from the Commissioner of Buildings. Application for such permit shall be made in writing and shall be accompanied by such plans and specifications of the proposed billboard or sign as are necessary to fully advise and acquaint the said Commissioner with the construction of such proposed billboard or sign. If the plans and specifications accompanying such application shall be in accordance with the provisions of this article, said Commissioner shall thereupon issue a permit for the erection or construction of such billboard or sign, upon the payment by the applicant of a fee as hereinafter fixed.

Sec. 1129. (Alteration and Repair of Billboards.)—No material alteration or repair of any billboard or sign shall be made, except upon a written permit issued by the Commissioner of Buildings authorizing such alteration or repair, and such permit shall be issued upon application in writing made to such Commissioner by the owner of such billboard or sign or by the person in charge, possession or control thereof, accompanied by a plan or written statement of the proposed alterations and repairs to be made, which, if satisfactory to and approved by the Commissioner of Buildings, shall authorize such applicant to receive a permit upon payment of a fee therefor as hereinafter fixed.

Sec. 1130. (Billboards Now Existing to Be Altered to Comply With the Provisions of This Article.)—Every now existing billboard or sign, whether erected upon or above the roof of any building or attached or fastened to the wall or walls of any building, or standing upon or erected upon any lot or premises, which is not erected or maintained in compliance with the provisions of this article, shall be forthwith removed or altered, changed or cut down so as to fully comply with such provisions; and any billboard or sign now existing and not complying with the provisions of this article, which shall not have been removed or torn down or so altered and changed within sixty days from and after the passage of this ordinance, as to be brought into conformity with the provisions of this article by the owner thereof or by the person in charge, possession or control thereof, shall be torn down by the Commissioner of Buildings and the cost and expense of tearing down and removing such billboard or sign shall be charged to the owner of such billboard or sign or the person in charge, possession or control thereof, and shall be recovered from such person for the use of the city by any proceeding deemed appropriate therefor.

Sec. 1131. (Duty of Commissioner.)—It shall be the duty of the Commissioner of Buildings to inspect all plans and specifications submitted in connection with the erection or construction or the alteration or repair of any billboard or sign, and to approve the same if the method of construction and provisions made for fastening, securing, anchoring and maintaining such billboards or signs are such as will serve to protect the public and to render such billboards or signs safe and substantial. It is further made the duty of the Commissioner of Buildings to exercise a supervision over all billboards and signs erected or being maintained under the provisions of this article; and whenever it shall appear to said Commissioner that any such billboard or sign is in an unsafe condition or has become unstable or insecure or in such a condition as to be a menace to the safety of the public he shall thereupon issue or cause to be issued a notice in writing to the owner of such billboard or sign or the person in charge, possession or control thereof, if the whereabouts of such person is known, informing such person of the condition of such billboard or sign and directing him to make such alterations or repairs thereto, or to do such acts or things as are necessary or advisable to place such billboard or sign in a safe, substantial and secure condition. If the person so notified shall refuse, fail or neglect to comply with and conform to the requirements of such notice, said Commissioner shall tear down or cause to be torn down and removed such billboard or sign, and shall charge the expense of such tearing down or removal to the person so notified. If the owner of such billboard or sign or the person in charge, possession or control thereof cannot be found, or his whereabouts is not easily ascertained, the Commissioner shall attach or cause to be attached to such

billboard or sign a notice of the same import as that required to be sent to the owner, where such owner is known, and if such billboard or sign shall not have been placed in a secure, safe and substantial condition, in accordance with the requirements of such notice, within thirty days after such notice shall have been attached to such billboard or sign, it shall be the duty of the Commissioner of Buildings to thereupon order such billboard or sign torn down and removed.

Sec. 1132. (Fees for Permits.)—The fee to be charged for permits issued for the erection or construction of billboards or signs or for the alteration or repair thereof shall be two dollars for each billboard or sign.

Sec. 1133. (Penalty.)—Any person or corporation owning, operating, maintaining, or in charge, possession or control of any billboard or sign within the city, who shall neglect or refuse to comply with the provisions of this article or who erects, constructs or maintains any billboard or sign that does not comply with the provisions of this article, shall be fined not less than twenty-five dollars nor more than two hundred dollars for each offense and each day on which any such person shall permit or allow any billboard or sign owned, operated, maintained or controlled by him to be erected, constructed or maintained in violation of any of the provisions of this article shall constitute a separate and distinct offense.

Sec. 1134. (Fences.—Height of.)—No wooden fences shall be constructed of greater height than eight feet above the sidewalk grade, or eight feet above the surface of the ground, where no grade is established.

ARTICLE XXIV.

STORAGE OF OILS.

Sec. 1135. (Storage of Oils.—Buildings for Storage of Oils.—Walls.—Roof.—Floor.)—Buildings designed for the storage of crude petroleum, gasoline, naphtha, benzine, camphine, carbon oil, spirit gas, burning fluid, spirits of turpentine, or coal, rock or earth oil (excepting such refined oils as will stand a fire test of one hundred and fifty degrees Fahrenheit according to the method and direction of John Tagliabue), shall be constructed as follows:

The walls shall be of brick, stone, or concrete, and shall be not less than sixteen inches thick or more than sixteen feet high. The lower floor of such buildings shall be at least three feet below the grade of the adjoining street and shall be made of earth, concrete or brick. The roof of such buildings shall be made of tile, metal or other incombustible material, and the outside walls of any such building having a flat roof shall extend at least eighteen inches above the roof. The coping upon the roof of such buildings shall be made of incombustible material. Such buildings shall be detached from all other buildings and shall be properly ventilated. Where any such building shall be located less than twenty-five feet away from any other building or structure, the wall or walls of such building on the side or sides thereof, within such distance of twenty-five feet from any other building or structure shall have no window or other opening therein; provided, however, that if such building cannot be so constructed that no outside wall thereof shall be less than twenty-five feet away from any other building or structure, in such case, openings may be made in the wall of such building which is located farthest away from any other building or structure for the purpose of admitting light or providing means of access thereto or egress therefrom. If such opening be a window, the glass in such window shall be fire-resisting glass, and such window shall be provided with a steel shutter.

No such building shall be occupied for any purpose other than the storage of oils, and no person shall be permitted to use any such building as a sleeping apartment or dwelling place.

The interior cubic capacity of any such building shall exceed by at least twenty-five per cent the total capacity of the tanks or other receptacles placed in such building.

Such buildings and the equipment thereof, including the protection of the doors and windows, shall be constructed according to plans and specifications which have been submitted to and approved by the Commissioner of Buildings.

Sec. 1136. (Tanks for Storage of Oils.)—Tanks for the storage of any one or more of the oils or fluids mentioned in the preceding section may be built outside of buildings either above or under the surface of the ground, provided the following specifications are complied with:

Such tanks shall be made of metal of sufficient gauge and tensile strength for the purpose for which they are to be used. All portions of such tanks are to be

riveted together and shall be made liquid tight. Every such tank shall have a manhole and shall be equipped with adequate ventilating or safety devices.

All tanks other than those located in buildings constructed under the provisions of Section 1135 of this article, whether placed above or below the surface of the ground, shall have no building or structure of any kind whatsoever over or above the same; provided, however, that if any such tank be located near a railroad track or manufactory or place where sparks are likely to fall, and it is desired, in order to obviate such danger, to construct over such tank a shed or shelter. Such shed or shelter may be constructed upon a permit in writing therefor being issued by the Commissioner of Buildings; and such permit shall only be issued if it shall be shown that such shed or shelter is necessary and upon the express agreement that such shed or shelter shall be used for no other purpose than affording protection or shelter, and shall not be used for storage, manufacturing, residence, office, or any other purpose whatsoever.

Sec. 1137. **(Walls Around Tanks.)**—Where any such storage tank or any portion thereof is erected or maintained upon or above the surface of the ground and is situated less than fifty feet from any other building or structure other than the buildings or structures upon the premises wherein such oils or fluids are to be used or stored, such tanks shall be separated from any such building or structure by an inclosing wall of brick, stone or concrete; and such wall shall be not less than five feet high and in no case of less height than two feet higher than the top of the tank which it is designed to separate from such building or structure. If such wall be ten feet high or less it shall be not less than twelve inches in thickness, and four inches in thickness shall be added for every additional ten feet or major fraction thereof of height added to such wall. Such wall shall entirely surround or inclose such tank; provided, however, that an opening may be constructed in such inclosing wall to permit access to the tank. Such opening shall contain a liquid-tight door made of incombustible material, either sliding or opening inward, and of sufficient strength to resist any pressure which may be brought to bear on such door by the bursting of the tank inclosed in such wall.

All such tanks and walls described in this section shall be constructed in accordance with plans and specifications which shall have been submitted to and approved by the Commissioner of Buildings.

Sec. 1138. **(Storage of Petroleum, Etc.)**—It shall be unlawful for any person or corporation to keep or store crude petroleum, gasoline, naphtha, benzine, camphine, carbon oil, spirit gas, burning fluid, spirits of turpentine, or coal, rock or earth oil (excepting such refined oils as will stand a fire test of one hundred and fifty degrees Fahrenheit, according to the method and direction of John Tagliabue), upon or in any structure or premises, in any quantity exceeding one barrel of fifty gallons, within the city, except in such a building or such tanks as are hereinbefore described in this article, and where a quantity of any of such oils exceeding five gallons and not exceeding fifty gallons is kept in any premises other than such a building the receptacle or receptacles in which such oils is or are kept shall not be placed under any stairway or in any confined space, but shall be kept in such manner that no vapor or gas therefrom can collect in such a quantity as to become dangerous; and no such receptacle or receptacles shall be stored, kept or handled at any time within fifteen feet of any gas, candle, oil or other like artificial light or near any lighted stove, gas grate or any open flame of any kind whatsoever; provided, however, that a quantity of such oils exceeding one barrel of fifty gallons and not exceeding five barrels of fifty gallons each may be kept or stored in a room or apartment, the floor of which shall be at least five feet below the grade of the street adjacent to the building or structure in which such room or apartment is located, and such room or apartment shall have an air capacity of not less than fifteen hundred cubic feet and shall be properly ventilated in such manner as to prevent a dangerous accumulation of vapor or gas from such oils; and such room or apartment shall not be used for any purpose other than the storage and handling of such oils. In any such room or apartment as is last above described turpentine may be kept in a quantity not exceeding five hundred gallons.

No gas, candle, oil, or other like artificial light or lighted stove, gas grate, or other open flame of any kind whatsoever shall be allowed within fifteen feet of any receptacle of receptacles containing any of the oils or fluids mentioned in this article, while located, kept, or stored in any such room or apartment. If more than fifteen (15) barrels of any of the oils hereinbefore described are kept in any such building as herein provided for, such building shall be located not less than 100 feet away from any other building or structure.

1137-8—718-719

Sec. 1139. **(Petroleum, Etc., in Transit Not to Be Kept Near Buildings.)**—It shall be unlawful for any person or corporation engaged in the business of transporting or delivering any of the oils or fluids mentioned in this article to permit such oils or fluids to remain in barrels, tanks, or other like receptacles, upon any railroad track, street, wharf, or dock for a longer time than is reasonably necessary to make provision for the storing or delivering of same; such time in no event, however, to exceed twenty-four hours.

Sec. 1140. **(Oils, Sale of, Regulated.)**—It shall be unlawful for any person or corporation to sell, deliver, or receive any of the oils or fluids mentioned in this article, by gas, candle, oil, or other like artificial light.

ARTICLE XXV.

MISCELLANEOUS PROVISIONS.

Sec. 1141. **(Roofs for Spectatorial Purposes.—Permits.)**—It shall be unlawful for any person, whether owner, lessee, manager or person in control or having charge of any building within the city, to permit the use of the roof of any house or building, whether free of charge or through admission fee, to any person as a place of observation or for spectatorial purposes, unless he has first obtained from the Commissioner of Buildings of the city a permit; provided, however, it shall not be unlawful for any person, whether, owner, lessee, or the person in control or having charge of such house or building, to permit the roof of any such house or building to be used as a place of observation or for spectatorial purposes for a number of persons not exceeding ten, and when no admission fee is charged.

Sec. 1142. **(Inspection as to Safety of Buildings.)**—Before issuing the permit, as provided for in the foregoing section, the Commissioner of Buildings shall make an investigation as to whether such building is safe and secure enough to permit the presence of an estimated number of persons upon the roof thereof, and the permit so issued shall state the number of persons to be permitted on such roof. The Commissioner of Buildings shall see to it that every such roof is surrounded and enclosed with a railing or balustrade of sufficient height and strength to afford adequate protection.

Sec. 1143. **(Fee for Inspection.)**—The person requiring such permit, as hereinabove provided for, shall make application to the Commissioner of Buildings for such an investigation, and shall pay, as a fee for such investigation and such permit, the sum of five dollars.

Sec. 1144. **(Penalty.)**—Any person, whether owner, lessee, manager or person having charge or control of any such house or building within the city who shall permit, allow or tolerate the use of the roof of such house or building so controlled by him, by any person for a purpose within the meaning of Section 1141 of this article, without first obtaining a permit as hereinbefore provided for, and without having the safety of such roof tested and investigated by the Commissioner of Buildings, as hereinbefore provided for, or who shall permit a larger number of persons than is provided for in his permit to congregate upon such roof, shall be fined not less than twenty-five dollars nor more than one hundred dollars for each offense.

Sec. 1145. **(Windows, Cleaning of.—Safety Devices.)**—The owner or agent of every building hereafter erected in the city shall equip each and every window in any such building, above the second story thereof, with a suitable device or devices which will permit the cleaning of the exterior of each and every window in such building, above the second story, without danger to the person cleaning such windows, such devices shall be of such pattern and construction as will reasonably answer the purposes for which they are intended. Provided, however, that if windows are of such size that they may be easily cleaned from the inside, they need not be equipped with such devices.

Sec. 1146. **(Penalty.)**—Any owner or agent of any building described in the preceding section who shall fail, neglect or refuse to comply with any of the provisions of such section, shall be fined not less than ten dollars nor more than fifty dollars for each offense, and each and every day which shall be allowed to elapse before any such building shall be supplied and equipped in accordance with the provisions of said section, shall constitute on the part of the owner or agent of any such building a separate and distinct offense.

Sec. 1147. **(Scaffolds.—Protection During Building Operations.—Temporary Floors.)**—All scaffolds erected in this city for use in the erection, repair, alteration or removal of buildings, shall be well and safely supported, and of sufficient width,

and properly secured, so as to insure the safety of persons working thereon or passing under, or by the same, and to prevent the falling thereof, or of any material that may be used, placed or deposited thereon.

It shall be the duty of every owner, person or corporation who shall have the supervision or control of the construction or remodeling of any building having more than three (3) framed floors, whether some or all of such floors are above or below the established street grade, to provide and lay upon the upper side of the joists or girders, or both, of the first floor below the riveters and structural steel setters, a plank floor, which shall be laid to form a good and substantial temporary floor for the protection of employes and all persons engaged above or below or on such temporary floor in such building.

Provided, however, that where the permanent floor is in place on the floor herein required to be planked, a temporary protective floor shall not be required.

If the floor or permanent floor of the second floor, or of any other floor above the second, or roof, is being placed previous to the permanent floor of the floor immediately below the floor which is being arched or planked, a good and substantial temporary floor shall be laid on the joists and girders of the next lower floor. For the purposes of this section the lowest framed floor in a building shall be considered the first floor.

In buildings more than three (3) stories high, where persons are working on a scaffold or scaffolds on the outside of such building, such persons shall be protected by well-secured planking, set over the heads of such persons for the full width of the scaffolding on which they are working, if another story or other stories are being raised above such persons during the time they are working on such outside scaffold or scaffolding.

It shall be the duty of all owners, contractors, builders or persons having the control or supervision of all buildings in course of erection which shall be more than thirty (30) feet high, to see that all stairways, elevator openings, flues and all other openings in the floors shall be covered or properly protected.

Sec. 1148. **(Penalty.)**—Any person violating any of the provisions of the foregoing section shall be fined not less than one hundred dollars nor more than two hundred dollars for each offense, and any permit granted for the construction of such building by the authorities of the city may be revoked in the discretion of the Commissioner of Buildings.

Sec. 1149. **(Gas or Electric Shut-off Device.—Outside of Building.)**—Every building within the city in which gas or electricity is used for illuminating, heating or other purposes shall be equipped with a device or devices which will enable firemen to shut off the supply of gas or current of electricity to any such building from the outside thereof; such device or devices to be placed at such a point or at such points on the outside of any such building as may be designated by the Fire Marshal of the city, and to be of such design and construction as to enable such device or devices to perform with reasonable certainty and safety the work required to be done thereby.

Any device or devices installed for the purpose of carrying out the provisions of this section shall first be approved by the Fire Marshal, and after the installation thereof the control of any such device or devices so installed in or upon any building under the provisions of this section shall be under the supervision of the Fire Department of the city.

Provided, however, that buildings used exclusively for residence purposes and outbuildings, sheds or barns attached or appurtenant to buildings used exclusively for residence purposes, shall be exempted from the provisions of this section.

Sec. 1150. **(Penalty.)**—Any owner, agent or person having control or charge of any building coming within the provisions of the foregoing section, who shall neglect, fail or refuse to equip any such building with a device or devices such as are described in the foregoing section, shall be fined not less than fifty dollars nor more than two hundred dollars for each offense, and each day which shall elapse before the equipment of any such building with a device or devices as herein required shall be deemed a separate and distinct offense, and any person who shall disturb, meddle or tamper with any device or devices installed under the provisions of the preceding section, upon any building or buildings, without authority from the Fire Marshal, shall be fined not less than ten dollars nor more than one hundred dollars for each offense.

Sec. 1151. **(License.—Contractors.)**—Every person or corporation engaged within the city in the construction or repairing of the whole or any part of buildings and appurtenances shall be and he or it is hereby required to obtain a license from the city which shall permit him or it to engage thereafter in the business of contracting for the erection of buildings and appurtenances or parts thereof.

1148 to 1151—729 to 732

Sec. 1152. (Application.—Conditions.)—Every application for such license shall be made to the Commissioner of Buildings and shall set forth the name and residence or place of business of the applicant and the nature of the work which he or it desires to engage in for a period of one year thereafter, and shall be accompanied by a fee of two dollars.

Sec. 1153. (License to Be Issued.)—Said Commissioner shall thereupon issue a license in due form, permitting the applicant to engage in the business of contracting for the erection of buildings and appurtenances, or parts thereof, in the city for one year from the date of such license, which date shall be the first day of May in the year in which such license is applied for, and no license shall be granted for any period less than a year, and all licenses shall run from the first day of May in each year until the thirtieth day of April in the succeeding year.

Sec. 1154. (Penalty.)—Any person or corporation who shall engage in the business of building in the city under contracts for the whole or any part of buildings and appurtenances, without first having obtained a license therefor as aforesaid, shall be fined not less than twenty-five nor more than one hundred dollars for each offense.

Sec. 1155. (Walls.—Structures.—Buildings Altered to Conform to Chapter.)—No wall, structure, building or part thereof shall hereafter be built, constructed, altered or repaired within the city except in conformity with the provisions of this chapter. No building already erected or hereafter to be built within the city shall be raised, altered or built upon in such a manner that if such building were wholly rebuilt or constructed after the passage of this ordinance it would be in violation of any of the provisions of this chapter.

Sec. 1156. (Buildings.—Expense of Altering Recoverable from Owner by City.)—Whenever, in the opinion of the Commissioner of Buildings, it shall be necessary to tear down, alter, repair or rebuild any building or portion of any building which is dangerous, defective or unsafe, or which is reported to the said Commissioner by the Commissioner of Health to be unfit for human occupancy, or which has been built in violation of any of the provisions of this chapter or of any ordinance regulating the construction of buildings hereafter passed, said Commissioner of Buildings shall cause such building or such portion thereof to be torn down, altered, repaired or rebuilt, or such work to be done thereon as he may deem necessary to render such building, or such portion thereof, safe or fit for human occupancy, and the expense thereof shall be recoverable from the owner or owners of such building by any proceeding that may be deemed appropriate.

Sec. 1157. (Penalty.—Fines for Violation of Chapter.)—Any person or corporation who violates, neglects or refuses to comply with, or who resists or opposes the enforcement of any of the provisions of this chapter, shall be fined not less than twenty-five nor more than two hundred dollars for each offense, and every such person or corporation shall be deemed guilty of a separate offense for every day on which such violation, neglect or refusal shall continue; and any builder or contractor who shall construct any building in violation of any of the provisions of this chapter, and any architect designing or having charge of such building who shall permit it to be constructed, shall be liable to the penalties provided and imposed by this section.

Sec. 1160. (Repeal of Prior Ordinances.—Exception.)—An ordinance passed March 28, 1898, known as the "Building Ordinance," and all amendments thereto, is hereby repealed. Such repeal shall not affect any suit or action or proceeding had or commenced in any court before the date when this ordinance takes effect, nor any offense committed, nor any forfeiture, nor any penalty incurred, nor any suit or prosecution pending for the recovery of any fine or penalty incurred under said ordinance passed March 28, 1898, and its amendments so repealed hereby.

Sec. 1161. (Style of Ordinance.—In Effect.)—This ordinance shall be known as "The Chicago Building Ordinance of 1905," and shall take effect and be in force from and after its passage.

1152 to 1157—733 to 738

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SIDEWALKS AND VAULT COVERING.

SYNOPSIS OF SPECIFICATIONS FOR CONCRETE AND STONE SIDEWALKS, AND FOR WALKS LAID OVER VAULTS, ETC., FROM ORDINANCE PASSED MARCH 23, 1904.

Requirements of the City as to quality of work, etc., must be observed under penalty.

Walks Laid on Filling.

Prepare foundation by cutting down or filling up to a sub-grade 14 inches below final sidewalk grade. Where filling is necessary it shall be of earth or cinders, or other material equally good, free from animal or vegetable matter, placed to leave a berme of one foot on each side of and flush with the top of the completed walk (except where the walks are laid full width of the sidewalk space), and shall slope to the natural surface 1½ feet horizontal to 1 foot vertical. Where necessary the foundation must be compacted until solid. Soft places must be dug out and refilled and thoroughly compacted. Upon this sub-foundation lay cinders, 9 inches in depth after being flooded and thoroughly tamped. Upon this foundation place a layer of hydraulic cement concrete 4¼ inches thick, composed as follows:

Concrete Mixed with Sand.

One part of cement equal in quality to the best Portland, 2½ parts of clean torpedo sand, ranging from ⅛ inch down to the finest, and 5 parts of crushed limestone, or other stone equally as good, or washed gravel, all free from dust and dirt or other foreign substances, and not less than ¼ inch or more than 1 inch in any dimension. The cement and sand shall be thoroughly mixed dry, after which it shall be moistened with water and made into a stiff mortar. The crushed stone or gravel to be sprinkled with water, then incorporated in the mortar and the mass thoroughly mixed by turning over with shovels, hoes, or mixers at least three times, and then placed on the foundation and rammed until solid.

The finishing layer, ¾ of an inch thick, 2 parts of cement equal in quality to the best Portland and 3 parts clean torpedo gravel or granite screenings put on before the first layer has set, and troweled to give the walk a smooth, even and glossy surface.

Space at Curb: A space of 1½ inches between all walks and the curb at street and alley intersections.

All mixing to be done on water-tight platforms.

All work on 5, 6, 10, 12, 15, 18, 20, 24 and 25 foot walks to be laid out in blocks 5 feet by 6 feet in size; on all other widths the stones to be uniform and to have a surface of not less than 24 square feet nor more than 36 square feet.

All walks to be laid on a line 1 foot from and parallel with the lot line unless ordered by special ordinance.

WALKS LAID OVER VAULTS, ETC.

Beam Work.

Substructure: Steel I beams set not more than 5 feet centers, the outer end to rest 8 inches on curb wall and be firmly bedded in masonry to the top flange. Where practicable the inner end of beam to penetrate the building wall 6 inches. Whenever beams rest on an area wall, and the clear span between bearing points exceeds 9 feet, wall must not be less than 12 inches thick.

Where no area or building wall exists cross beams shall rest on or be framed into a girder beam and fastened to same with proper angles and thoroughly bolted or riveted. All intersecting or girder beams to be 1 inch deeper than the cross beams, which are to rest on or be framed into them.

Said girder beams to be supported by circular cast iron columns, not more than 8½ feet apart from centers, and not less than 5 inches external diameter and metal not less than ½ inch thick, free from blow-holes and defects.

Columns to rest on 12 by 12 inch iron plates 1 inch thick, firmly bedded in a concrete foundation not less than 18 inches thick and having a surface bearing not less than 4 square feet. The top of column shall have a square plate 1 inch thick, fitted

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with a shoe formed in same, in which the girder beam shall rest. Columns over 10 feet to be ¾ inch metal, and 6 inches external diameter.

The top of the completed iron substructure shall be parallel with and 4 inches below top of finished walk.

The following sized steel cross beams shall be used:

Span in Feet.	Beams Deep in Inches.	Weight per Ft., lbs.
6 and 7	6	12¼
8	7	15
9 and 10	8	17¾
11 and 12	9	21 to 25
13	10	25
14, 15 and 16	12	31½
17 and 18	12	40
19 and 20	15	42

If necessary to change spacing between beams or use a beam of different depth than specified, the spacing shall be so changed, or such beam shall be of sufficient weight to give it bearing strength equal to the beam specified.

Concreting: Between the beams set in place and securely fastened to the lower flange, shall be placed temporary centers, smooth on the upper surface, which shall be removed when the concrete is set, the top or crown of same shall be two inches below the top of the steel cross beams.

Upon the above forms shall be placed the concrete, composed of the same kind of material, in the same proportions, etc., as the concrete specified for sidewalks, especial care being given to tamping and ramming, and brought to a grade three inches above the top of the steel substructure and 1 inch below and parallel with the top of the completed walk. The finishing layer, 1 inch thick, composed of two parts of cement, equal in quality to the best Portland, and 3 parts screened torpedo gravel, or granite screenings, to be put on before the first layer has set, and troweled sufficiently to give the walk a smooth, even and glossy surface, joints to be formed over the center of each I beam in the concrete as well as in the top dressing, and extend over the curbing down to the pavement.

Any system or method of vault construction equal to the above system may be used in lieu thereof, but in all cases any plans calling for beams or a construction of a size or character different from the above sizes and weights must be submitted to the Commissioner of Public Works for approval before construction is commenced and must be capable of sustaining a distributed safe load of 300 pounds per square foot, including weight of walk.

A stamp or plate giving the name and address of the contractor or person building the walk and the year in which the work was done. The top of said plate or stamp must not cover more than 54 square inches of surface, shall be flush and even with the top of the finished walk and must be of a permanent character.

Wherever one contractor or person has laid walks in front of three or more adjoining lots in one stretch, one of the stamps placed at each end of stretch of walk will be sufficient.

Slope: All sidewalks to be so constructed that the grade shall be a uniform incline, with a fall of 1 inch in every 3 feet.

Curbage: The curbage shall have a top dressing 1 inch thick, and shall extend 4 inches below the top of the pavement. When finished it shall present a true and perfectly plumb appearance; all joints to be straight and clean cut.

Driveways shall conform to the sidewalk grade and shall be 9 inches in depth, consisting of a layer of concrete 7 inches in depth and a finishing layer of 2 inches. Work to be as specified for Portland concrete walks.

Stone Sidewalks shall be constructed of the best quality of limestone, quarried a sufficient time to be seasoned and thoroughly frost proof. Stone to be free from cracks, etc., sawed or planed, with full joints grooved for 1¼x⅜ inch iron bars, the ends to be full and heads dressed to a uniform thickness. No stone to be less than 4½ feet wide and of the following thicknesses:

For walks 8 feet wide the stone shall be not less than 6 inches thick.
For walks 10 feet wide the stone shall be not less than 8 inches thick.
For walks 12 feet wide the stone shall be not less than 10 inches thick.
For walks 14 feet wide the stone shall be not less than 12 inches thick.
For walks 16 feet wide the stone shall be not less than 14 inches thick.

Stones to be bedded on the curb wall on the outside and inside on 6x8 inch iron lintels of 1¼ inch metal, supported by circular cast iron columns not less than 8 feet in length set not more than 8 feet apart from centers; on foundation of stone

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not less than 12 inches deep, and having a surface bearing of not less than 4 square feet. Columns to be of the best quality of cast iron, free from all defects, of the following sizes external diameter:

For walks 8 feet wide or less 4 inch columns of ½ inch metal.

For walks 10 feet wide or less 5 inch columns of ½ inch metal.

For walks 12 feet and over 6 inch columns of ½ inch metal.

Columns over 10 feet in length shall be of ¾ inch metal and 1 inch greater in external diameter than the sizes specified above.

All joints in the walk to be made water tight by caulking with oakum and pitch.

Slope: All sidewalks to be so constructed that the top surface shall coincide with the grade of the space between the curb line and the street line, which grade shall be a uniform incline from the street line toward the curb line, with a fall of 1 inch in every 3 feet.

BOILER (STEAM) AND SMOKE INSPECTION DEPARTMENT.

AN ORDINANCE

As amended February 8, 1904.

Creating a Department for the Inspection of Steam Boilers and Steam Plants.

Be it ordained by the City Council of the City of Chicago:

Section 1—**Department Created—Chief Inspector:** There is hereby created a department for the inspection of steam boilers and steam plants, the head of which shall be known as the Chief Inspector of Steam Boilers and Steam Plants, who shall hold office for a term of two (2) years and until his successor shall be appointed and qualified.

Sec. 2—**Appointment:** He shall be appointed by the Mayor subject to confirmation by the City Council.

Sec. 3—**Qualification:** The person so appointed shall be well qualified from practical experience in the design or construction and operation of boilers, generators, and superheaters, and their appurtenances, used for generating steam for power, steaming or heating purposes, to enable him to judge of their safety for use as such. No person employed in the department created by this ordinance shall be directly or indirectly interested in the manufacture, ownership, or agency of steam boilers or other apparatus or appliances used in the generation or use of steam, which are to be inspected.

Sec. 4—**Bond:** Said Chief Inspector of Steam Boilers and Steam Plants, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of five thousand dollars ($5,000) with two or more sureties to be approved by the Mayor, conditioned for the faithful performance of the duties of his office.

Sec. 5—**Supervising Mechanical Engineer:** There is hereby created the office of Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants, who shall be appointed by the Chief Inspector of Steam Boilers and Steam Plants from the eligible list to be prepared in accordance with the Civil Service Act and the rules of the Civil Service Commission.

Sec. 6—**Bond:** Said Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of five thousand dollars ($5,000), with two or more sureties to be approved by the Comptroller, conditioned for the faithful performance of the duties of his office.

Sec. 7—**Chief Smoke Inspector:** There shall be a Chief Smoke Inspector, who shall be appointed by the Chief Inspector of Steam Boilers and Steam Plants from an eligible list prepared in accordance with the Civil Service Act, and the rules of the Civil Service Commission.

Said Chief Smoke Inspector, before entering upon the duties of his office, shall execute a bond to the City of Chicago in the sum of five thousand dollars ($5,000), with two or more sureties to be approved by the Comptroller, conditioned for the faithful performance of the duties of his office.

Sec. 8—**Board of Inspectors of Steam Boilers and Steam Plants:** The said Chief Inspector of Steam Boilers and Steam Plants, Supervising Mechanical Engineer and Deputy Inspector of Steam Boilers and Steam Plants, and Chief Smoke Inspector shall

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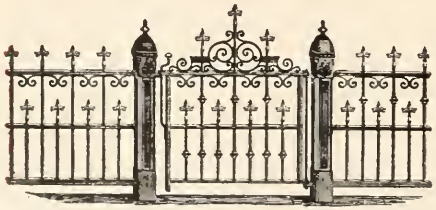

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constitute the Board of Inspectors of Steam Boilers and Steam Plants. The Chief Inspector of Steam Boilers and Steam Plants shall be Chairman of said Board, and the Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants shall be Secretary of said Board. Any two members of said Board shall constitute a quorum. Said Board shall have the same power over all steam boilers and steam plants owned or operated by the City of Chicago, or the Board of Education, as over all other steam boilers and steam plants in said City of Chicago; and all steam boilers and steam plants owned, operated, or controlled by the City of Chicago, or Board of Education of said City, shall be subject to the requirements of this ordinance; and it shall be the duty of said Board of Inspectors of Steam Boilers and steam plants to inspect at least once in each year all of such steam boilers and steam plants as are owned, operated, or controlled by the City of Chicago, or by said Board of Education, and also to preserve a record of the condition of such steam boilers or steam plants as shown by such inspection. And no fee shall be charged or paid to said department nor to any employee under said department, for the inspection of any steam boiler or steam plant or for the certificate of inspection issued by said department for any steam boiler or steam plant owned, operated, or controlled by said City of Chicago or said Board of Education.

Sec. 9—**Duties of the Board:** It shall be the duty of the Board to inspect all boilers, tanks, jacket kettles, generators or other apparatus used for generating or transmitting steam for power, or using steam under pressure for heating or steaming purposes, and all other tanks, jacket kettles and reservoirs under pressure of whatsoever kind, except as hereinafter provided, as often as once in each and every year, by making a hydrostatic pressure test where such tests shall be deemed necessary; provided, that the hydrostatic pressure used in such test shall not exceed the maximum working pressure of said apparatus by more than fifty per cent; and by making a careful external and internal examination. In all cases where hydrostatic pressure test is used an internal examination of said apparatus shall afterwards be made. In certifying the working pressure allowed on each steam boiler, steam generator or other apparatus the same shall be determined by multiplying one-fifth of the lowest tensile strength of any plate in the cylindrical shell of said steam boiler or steam generator or other apparatus by the lowest efficiency of joint in such cylindrical shell expressed in decimals, and by multiplying the product by the thickness, expressed in inches or parts of an inch, of the thinnest plate in the same cylindrical shell and divide by the radius, also expressed in inches. This sum will be the pressure allowable per square inch of surface.

Any boiler, tank, jacket kettle, generator or reservoir having been in use eight years or more and its condition being such that in the opinion of the inspector the same should be drilled in order that the exact thickness and condition may be ascertained, he shall report the same to the Chief Inspector of Steam Boilers, who shall serve the owner or agent with a written notice to show cause to the Chief Inspector within five days why such boiler, tank, jacket kettle, generator or reservoir should not be drilled.

If, after the owner or agent has been heard, or at the end of five days, the Chief Inspector deems it necessary that the boiler, tank, jacket kettle, generator or reservoir be drilled, then the boiler, tank, jacket kettle, generator or reservoir may be drilled at points near the water line, and at the bottom of shell of boiler, or such other points in the boiler, tank, jacket kettle, generator or reservoir as the inspecting officer may direct, and the thickness of said material shall be determined thereafter at such annual inspection as the inspecting officer may deem necessary, and the steam pressure or other pressure allowed shall be governed by such ascertained thickness and general condition of boiler, jacket kettle, generator or reservoir. And the drilling and plugging of said holes shall be done at the expense of the owner.

Any boiler may be tested and rated in accordance with the United States Marine Inspection Law governing the inspection of steam boilers. But no boiler, tank, jacket kettle or jacket constructed or re-constructed of boiler plates hereafter, where the same are required, shall have stay bolts of less than seven-eighths of an inch in diameter and pitched more than seven inches apart. And all stationary boilers, tanks, jacket kettles or jackets carrying a pressure of one hundred pounds or over to the square inch, the construction of which requires stay bolts shall be equipped with hollow stay bolts. All boiler heads made of boiler plate shall be braced with braces, the sectional area of which shall not be less than one square inch each, so pitched that a greater strain than six thousand pounds per square inch of section shall not be carried by any one brace or stay bolt. In computing the strain on braces in flat surfaces the diameter of brace rivets shall be considered. In computing the strain on shells having dished heads the pressure will be figured according to the radius of the heads.

Sec. 10—**The emission of dense smoke from the smoke-stack of any boat or locomotive, or from any chimney anywhere within the city, shall be deemed, and is hereby**

declared to be, a public nuisance, but no prosecution for the emission of dense smoke shall be commenced, unless within ten days prior thereto at least three notices shall have been mailed to the offender that dense smoke has been seen emitted from his premises.

The owner or owners, lessee, agent, or manager of any boat or locomotive, and the proprietor, lessee, or agent of any building, factory, mill, works, or other establishment having smoke-stacks or chimneys, who shall permit or allow dense smoke to issue or to be emitted from the smoke-stack of any such boat or locomotive, or the chimney of any building, factory, mill, works, or other establishment having smoke-stacks or chimneys within the corporate limits to exceed three minutes (excepting in cases where the fire box is being cleaned out or new fire built therein, in which cases the limit shall be six minutes), in any hour of the day or night, shall be deemed and held guilty of creating a nuisance, and shall for every such offense be fined a sum of not less than ten dollars ($10) nor more than one hundred dollars ($100).

It shall be the duty of the Board to see that the boiler or boilers, boiler setting, means of producing draft, smoke connections, and furnace or fire-box of each boiler inspected by it are of sufficient capacity and so constructed as with proper management to avoid the emission of dense smoke.

Prosecutions for all violations of this ordinance by persons allowing dense smoke to issue from any chimney shall be brought by the Chief Smoke Inspector, and the prosecutions for all other violations of this ordinance shall be brought by the Chief Inspector or Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Pipes, in the name of the City of Chicago.

Provided, that no prosecution under this ordinance shall be commenced against the owner, or owners, lessee, agent or manager of any boat, locomotive, or the proprietor, lessee or agent of any building, factory, mill, works or other establishment having smoke stacks or chimneys, the plant of which shall have been installed prior to the passage of this ordinance, until the expiration of one year after the passage of this ordinance, within which to rebuild and re-equip the same in accordance with the provisions of this ordinance; Provided, further, that no such owner, owners, lessee, agent or manager shall be entitled to said one year unless he shall at once commence his plans for the rebuilding and re-equipping of such plant and shall proceed with said work to the satisfaction of the Board upon inspection at intervals of three months during said period of one year.

Sec. 11—**Permit for New Plants:** From and after the passage of this ordinance, no new plants, nor any reconstruction of any old plants, for producing power and heat, or either of them, nor any new chimney connected with a steam plant, shall be erected or maintained in the City of Chicago until the plans and specifications of the same have been filed in the office of and approved by the said Board, which plans and specifications shall show the amount of work and the amount of heating to be done by said plant and all the appurtenances thereto, including provisions for the complete combustion of the fuel to be used and for the prevention of smoke, and a statement of the kind of fuel proposed to be used. Said plans and specifications shall also show that the room or apartment in which said plant shall be located is provided with doors, windows, air-shaft, fans, and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement, or other portion of such building wherein said steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty (120) degrees Fahrenheit, or that the atmosphere of any such apartment wherein such apparatus may be located may be entirely renewed every ten minutes. Upon approval of said plans and specifications, a duplicate set of which shall be left on file in said office, and the payment of fees as hereinafter provided, said Board shall issue a permit for the installation of said plant or said reconstruction. Said permit shall state the maximum amount of steam pressure to be carried. As soon as the Board hereby created has examined the plans and specifications submitted for a new steam plant in a new building and has issued a permit for the installation of same, it shall notify the Commissioner of Buildings to see that the execution of the construction work on the building in which such plant is to be installed is carried out in conformity with the plans and specifications of the proposed steam plant for the execution of which a permit has been issued, with special reference to the amount of space to be used for such appurtenances, the size and construction of the chimney or chimneys to be used, and the provisions for ventilation and proper temperature in the engine and boiler rooms.

It shall be the duty of the Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants to examine in detail all plans and specifications that may be submitted to the Board, and to report upon the same for approval by the Board. All permits shall be issued by an affirmative vote of a majority of the Board.

Sec. 12—**Duty of Owners:** It shall be unlawful for any person to use any steam boiler or any tank or tanks subject to pressure other than City pressure, until he shall have first procured a certificate from said Board that said apparatus may be

safely used, and that the boiler or boilers, boiler setting, means of producing draft, smoke connections, and furnace or fire-box are of such size and capacity that they will do the work required, and be capable of being so managed for the purpose of generating steam that no dense smoke shall be emitted from the chimney connected with such furnace or fire-box.

If such owner, agent or person using a steam boiler or tank shall fail to notify said Board of his intention to make any alteration, repairs or enlargement of such steam plant, and shall fail to file plans and specifications for the enlargement or alterations of the same, and shall proceed to make such alterations, repairs or enlargement without a permit therefor, he shall be liable to a fine of twenty-five dollars ($25.00) for each day on which he shall have prosecuted such alteration, repairs or enlargement without said permit, and each day's violation shall constitute a separate offense. Provided, however, that minor necessary or emergency repairs which do not increase the capacity of said apparatus or involve any substantial alteration of structure may be made by or under the engineer in charge of said apparatus without permit or report thereof.

If at any time when inspecting a steam boiler, generator or other apparatus used for generating steam for power or heating purposes the Inspector of Boilers shall find that the furnace or fire-box in which fuel is used for the purpose of generating steam is so constructed or operated as to cause the emission of dense smoke from the chimney connected therewith he shall report to said Board the condition of said plant. The owner of said steam boiler, generator or apparatus shall have the right to put in such appliance or make such alterations or use such fuel as in his judgment will prevent the emission of dense smoke, but this shall not constitute a compliance with this ordinance unless such appliance or such fuel shall actually prevent the emission of dense smoke.

Provided, however, that this ordinance shall not apply to tanks, jacket kettles or reservoirs of under seventy-five gallons capacity, hot water tanks used for domestic purposes, boilers on locomotives or boilers, generators or other apparatus used in private residences for generating steam solely for heating purposes; and for the purpose of this ordinance flat buildings or apartment buildings with more than three apartments shall not be classed as private residences, and any steam boiler, generator or other apparatus carrying other than City pressure in flat buildings or apartment buildings having more than three flats or apartments shall be subject to inspection as hereinbefore provided.

Provided, also, that any boilers for heating purposes only, in which the permit specifies that not more than ten pounds of steam pressure to the square inch shall be carried, shall be known as "low pressure boilers."

After the next inspection of such boilers shall have been made following the adoption of this ordinance, inspections thereafter shall be made once in every three years. But all of such low-pressure plants may be inspected at any time thereafter, and without charge, with reference to the provisions for draft, complete combustion or degree of combustion of fuel and prevention of the emission of smoke.

Sec. 13—**Certificate—Record:** When an inspection of a boiler or boilers, tank or tanks, jacket-kettle, generator or generators, superheater or superheaters, or any apparatus under pressure, has been made, and the same shall be approved by the Chief Inspector or Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants, he shall make and deliver to the person for whom the inspection was made, upon the payment of the fees hereinafter mentioned, a certificate of such inspection, which shall contain the date of inspection, together with a general description, for what purpose used, the number of try-cocks, steam and water gauges, the pounds pressure at which they may be safely used; which certificate shall be framed and put up in a conspicuous place in the engine or boiler room, and a record of the same shall be made and kept by said Board, in a well-bound book or books, indexed alphabetically or by locality. But such certificate shall not be a waiver of liability in the case of any prosecution for the making of dense smoke.

Sec. 14—**Inspection of Repairs:** It shall be the duty of said Inspector, upon an application in writing made by any person, firm, corporation, or agent, owning, leasing or controlling the use of any boiler, tank, jacket-kettle, generator, or superheater, stating that the same is out of repair or has been repaired, to examine the same when so repaired, and determine if such repairing has been properly done; and it shall be unlawful for any person, firm, corporation, or agent to use any boiler, tank, jacket-kettle, generator, or superheater, after the same has been repaired, until a certificate shall have been procured from the Inspector to the effect that such repairing has been properly done, and such boiler, tank, jacket-kettle, generator, or superheater may be safely used, except as hereinbefore provided in Section 12 of this ordinance.

Sec. 15—**Fees:** The fees for inspection of steam boilers and other apparatus under this ordinance shall be as follows:

Class A—Including steam boilers, tanks, jacket-kettles, of a capacity of seventy-five gallons or over, generators, or other apparatus under a pressure exceeding ten pounds per square inch in plants where only one such apparatus is used, Five Dollars each.

Class B—Steam boilers, generators, or superheaters using steam under pressure exceeding ten pounds per square inch in plants where more than one such is used, five dollars for the first and three dollars for each additional apparatus.

Class C—Tanks and jacket-kettles, of a capacity of seventy-five gallons or over, under pressure in plants where more than one such tank or jacket-kettle is used, one dollar each for all after the first.

Class D—All low-pressure steam boilers as herein described in Section 12, three dollars each.

Class E—The fee for a permit for a new steam plant or for additions to an old plant shall be five dollars for each boiler installed.

All fees provided for in this ordinance shall be paid to the City Collector.

Exemptions—Charitable, Religious and Educational Institutions—Said Board may, and it is hereby directed and instructed to, remit all inspection fees charged, or that may hereafter be charged, against any and all charitable, religious, and educational institutions, when the boiler or other apparatus inspected is located in or upon premises used and occupied exclusively by such charitable, religious or educational institution: provided that such charitable, religious, or educational institution is not conducted or carried on for private gain or profit, and provided further, that said Board may require every application for the remission of such fees to be verified by the affidavit of one or more taxpayers of the City of Chicago.

Sec. 16—**Charging excess fees:** If any person shall take or receive any money or any valuable thing from any person for the purpose of deceiving or defrauding any person or persons, or for the purpose of favoring any person or persons, or if any inspector shall recommend the issue of any certificate of inspection without having at the time stated thoroughly examined and tested the boiler so certified, he shall be liable to a fine in the penal sum of one hundred dollars ($100), and his action shall be immediately reported by said Board to the Civil Service Commissioners.

Sec. 17—**Try-cocks, Gauges, Force Pumps:** It shall be the duty of every person, firm, corporation, or agent, owning, leasing, or controlling the use of any steam boiler or boilers, subject to inspection, as hereinbefore provided, to provide and properly affix to each and every one of such boilers a full complement of try-cocks, one water gauge, one fusible plug of good Banca tin, one or more pop safety valves (the area of pop valves shall be in the ratio of one square inch to three square feet of grate surface): Provided, that on boilers used for generating steam for heating purposes only and carrying not more than ten (10) pounds steam pressure, direct weighted safety valves may be used. On each steam boiler or steam generator, or other apparatus subject to inspection, there shall be placed a suitable shut-off or main stop valve so placed as to prevent the water passing into the heating apparatus during the test made at the time of inspection; provided that shut-off or main stop valves shall be required only in plants to be hereafter installed, and a good and sufficient force pump or other means of supplying the boiler with water; also a good and sufficient safety valve or reducing valve to all tanks or jacket-kettles, properly attached. No stop or shut-off valve shall be placed between a boiler, tank, or jacket-kettle and the safety valve.

After inspection the Inspector shall seal all safety valves, and said seal shall not be broken except by authority of said Board, except in case of emergency, and when the seal is broken a complete report of the same shall be made to said Board within twenty-four (24) hours; said valve shall be resealed forthwith by said Board without charge, provided the circumstances of the breaking of such seal are approved by said Board.

Sec. 18—**Owners to Provide Facilities:** All owners, agents, or other person using steam boilers, tanks, jacket-kettles, generators, or superheaters, subject to inspection as aforesaid, shall provide at their own expense such arrangements and facilities for attaching the instruments of inspection as the Inspector shall require. Immediately before the time set for such inspection, all such owners and persons shall remove all scale, dirt, soot, and sediment in, beneath, and around said boiler, shall fill the same with water, when so directed by the Inspector, and have all main stop valves and other valves and connections on said boiler or boilers perfectly tight, so that the Inspector may be able to apply hydrostatic pressure, leaving all said apparatus in clean condition for inspection.

Sec. 19—**Engineer's Negligence, Maximum Pressure, and Safety Valves:** Any engineer or other person in charge of a steam boiler or generator who shall negligently or wrongfully endanger the life of any person by permitting the water to fall below three inches above the flues or crown sheet of any boiler, or shall disturb the spring or weight on the safety valve, or break the seal of the safety valve, or tamper with it so

as to carry more pressure than allowed by the Inspector, or who shall otherwise neglect his duties, shall be subject to a fine of not less than $25 nor more than $100, and it shall be the duty of the Chief Inspector to report the facts to the Board of Examining Engineers.

The safety valves of steam boilers shall not be loaded to sustain more than the maximum pressure allowed by said Inspector, and the area of the discharge of each safety valve shall be equal to the full area of the valve, and all safety valves shall be directly open to the atmosphere.

Sec. 20—**Manufacturers and Dealers—Notify Inspectors:** Any person, company, or agent manufacturing, dealing in, selling, or erecting steam boilers, tanks, jacket-kettles, or generators, subject to inspection under this ordinance, shall, on the sale or delivery of such steam boiler, tank, jacket-kettle, or generator at any point or locality within the city, notify the said Board, giving the name of the owner, name of maker, number and name of street, or otherwise designate the locality of said delivery or sale; shall state also the thickness and quality of the material used in the construction and the brand stamped on the plate.

Sec. 21—**Second-Hand Dealers:** All steam boiler manufacturers, second-hand steam boiler and junk dealers, and any other person or persons selling second-hand steam boilers, tanks, jacket-kettles, generators, or superheaters, must, before painting the same, have them inspected by the Department of Steam Boilers and Steam Plants, and have in their possession a certificate issued by said Department, showing the amount of pressure per square inch the said steam boiler, tank, jacket-kettle, generator or superheater is allowed to carry before offering for sale any second-hand steam boiler, tank, or jacket-kettle, generator, or superheater, and give the buyer the said certificate of inspection. Any person or persons, firm, or corporation violating this section shall be liable to a fine of not less than ten dollars ($10), nor more than one hundred dollars ($100), for each and every offense.

Provided that any person or persons disposing of a second-hand steam boiler, tank, jacket-kettle, generator, or superheater, which has been in use, shall not be required to secure inspection if said steam boiler, tank, jacket-kettle, generator, or superheater is sold to a dealer in or repairer of such apparatus, but such inspection shall be had before such articles are sold for use.

Sec. 22—**Penalty:** Any owner, agent, or user of steam boilers, or other person, who shall violate any of the provisions of this ordinance, where no other penalty is provided, shall be subject to a penalty of not less than twenty-five ($25), nor exceeding one hundred dollars ($100), for each and every offense.

Sec. 23—**Apparatus:** The City of Chicago shall provide such instruments, books, papers, and equipment as shall be necessary for the proper performance of the duties of such Board, which shall be the property of said City, and which shall be delivered by said Board to its successors in office. Said Board shall report annually to the Mayor and City Council, or as often as required by said Council.

Said Board shall prepare and keep in its office a record of each steam boiler, steam generator, tank, jacket-kettle, or other apparatus used for the generation of steam or under pressure other than City pressure, and at the first inspection of any such apparatus under and by virtue of this ordinance a number shall be securely stamped upon the same with a steel stamp or die, of not less than one-half inch in height, in a conspicuous and easily accessible place upon said apparatus, which number shall be the office number of such piece of apparatus, and the designation by which the same shall be known in said record after such inspection; and said record shall contain a full description of such piece of apparatus, together with the use for which it is employed, the place where it may be located, the name of the owner, agent, or lessee of said apparatus, together with the amount of pressure allowed by the Inspector for the same, and the kind of fuel used, together with the number of try-cocks, steam and water gauges, and any special information pertaining thereto, including a record of inspections made.

Sec. 24—**Salaries:** The salary of the Chief Inspector of Steam Boilers and Steam Plants shall be $3,600 per annum, that of the Supervising Mechanical Engineer and Chief Deputy Inspector of Steam Boilers and Steam Plants $3,600 per annum, and that of Smoke Inspector of Steam Boilers and Steam Plants $2,000 per annum. There shall be appointed in addition to the above named officials a Chief Clerk and such other assistants, inspectors and employes as the City Council may by ordinance prescribe and establish. It will be the duty of the Assistant Inspectors to report defects in furnaces and smoke-stacks as well as in boilers, and it shall be the special duty of the Deputy Smoke Inspectors to report dense smoke emitted from chimneys, together with the probable causes therefor, determined by them on investigation of the plants connected with such chimneys.

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Section 25—This ordinance shall take effect May 1, 1903. On that day the Inspector of Steam Boilers, for the time being, shall turn over to the Board hereby established all the books, accounts and property of the City of Chicago in his charge and possession, and close up his accounts with the City Comptroller, and the Commissioner of Health shall transfer to the Board hereby created all the books and accounts of the Smoke Inspector.

Sec. 26. Upon the passage and approval of this ordinance a copy of the same shall be mailed by the Department so created to all users of steam power coming within the Department's jurisdiction, within ninety days after the passage of the same.

Sec. 27. Sections 1046, 1047 and 1048, and Sections 1936 to 1939 inclusive, and Section 1952 of the Revised Code of the City of Chicago of 1897 and an ordinance passed by the City Council December 29, 1897, relating to the office of Boiler Inspector, and all orders and ordinances amending and affecting said sections and said ordinance of December 29, 1897, are hereby repealed; provided, that this section shall not affect or operate to discontinue, discharge, or abate any suit or suits heretofore commenced by the City of Chicago, under any of said sections of the Revised Code of the City of Chicago or under said ordinance of December 29, 1897, and which suit or suits shall be in any wise pending in any court at the time this ordinance takes effect; but said sections of said Revised Code of Chicago and said ordinance of December 29, 1897, shall continue and be in full force and effect so far as said cases so pending are concerned.

SPECIFICATIONS FOR STANDARD HOLLOW TILE FIREPROOFING.

GENERAL.—The contractor for this work will be required to furnish all the material and labor of every description required to erect the same in place complete. The contractor is referred to the plans and details for the general construction, and especially the steel diagrams and details showing connection between the structural steel and tile work.

SPECIAL SHAPES.—The contractor shall furnish all necessary special shapes for the proper fitting to the steel work.

DETAILS.—When requested to do so the contractor shall furnish large scale details or full sized drawings for all special shapes, column coverings, lintel covers, girder covers, and general type of arch, which shall be submitted to the architects for their approval.

SCAFFOLDING, TOOLS, ETC.—Furnish all the tools, machinery, hoisting apparatus and centering necessary to carry on the work at the rate of progress stipulated in the contract.

TILE.—All the tile required for this work shall be of the best quality of hard burned fire clay, semi-porous, or porous terra cotta. This tile to be well manufactured, no badly split, cracked or warped tile will be permitted to go into the work.

MORTAR AND LAYING.—All tile work for the floor construction shall be laid in mortar composed of one (1) part American Portland Cement, of approved brand, four (4) parts sharp sand and one part (1) lime mortar, all thoroughly well mixed together as follows: The sand and cement are to be mixed together dry and sufficient water added to thoroughly wet the same, after which the lime mortar is to be added and the whole mass is then to be thoroughly tempered. All other tile work is to be laid in mortar composed as follows: One (1) part Louisville, Rosendale, or other natural cement, three (3) parts sharp sand and one part lime mortar, thoroughly mixed in the manner before described. All tile must be laid with full flush joints, plumb, to a line, with horizontal beds uniformly level on each course. Fill all the joints, chinks and crevices between the tile and steel work with mortar well slushed in.

TYPE OF ARCH.—The arches for the floors in general shall be ——— inch; flat or segment arches, with side or end construction. Skewbacks carefully bedded in place against beams.

BEAM TILE.—The soffits of all beams to be protected with slabs of tile at least 1 inch in thickness. If more than one inch, the beam tile must be made with air space next to beam.

ROOFS.—The arches for the main roof are to be ——— in segment or flat arches same as specified for the floors.

MINOR ROOFS.—The roofs of pent houses, roof over projecting portion in second story, floor of bulkheads, and other portions indicated on details as book-tile shall be made of three-inch (3 in.) book-tile set in place between tee-irons. Tee-irons to be furnished by the iron contractor.

PARTITIONS.—All partitions shown on the plans to be built the thickness indicated in figures. If no dimensions are given, the following sizes will govern:

Partitions for all corridors and for partitions over 12 feet and up to 14 feet in height to be 4 inches. Partitions over 14 feet in height to be 6 inches, and all cross partitions 12 feet or less to be 3 inches. Partition walls to be built straight, true, plumb and well bonded with proper "breakjoint" bond on each alternate course, and all joints thoroughly flushed up with mortar, and to be well wedged underneath.

FURRING TILE.—Where indicated on plans, 2 inch furring tile are to be built against the outside walls of the building. These tiles are to be secured to the brick walls with 10d spikes on every third course, driven into the brickwork at intervals not greater than 48 inches apart.

CURB WALL.—The curb wall in basement shall be furred with three-inch (3 in.) tile extending up to the under side of the iron plate along edge of curb wall and properly fitting around all beams.

ROUGH FRAMES AND BLOCKS.—The contractor for carpenter work will furnish and erect the rough wood frames at all openings in partitions and furring. He will also furnish all wooden blocks necessary to form nailing facilities for attaching plaster grounds, etc. These blocks must be built in place by fireproofing contractor wherever directed by the architect.

COLUMN COVERING.—All column covering shall start, in all cases, directly from the tile arches of floor. Column covering shall be designed to properly fit the columns.

All corners of square columns shall be left square or round. Column covering to be wired on once or twice in each course in height or secured together with clamps.

COVERING EXPOSED STEEL WORK.—All girders, beams, channels, etc., that show below the under side of ceilings are to be encased on all sides with at least 1-inch thickness of fire-proof tile secured to the steel in the usual manner. If required, special designs must be submitted to the architect.

BOXES FOR PLUMBING PIPES.—All soil, vent, down spout and water supply pipes shall be boxed in, using three-inch (3 in.) tile, starting from the floor tile in all cases. This boxing shall not be done until the pipes have been properly tested, and covered by another contractor. There shall be no openings into boxes except for outlets on the various floors. Where these outlets occur small wood frames furnished by carpenter shall be set by the fireproofing contractor.

BULKHEADS.—All bulkheads of first and second floor shall be built of 3-inch tile; the structural iron contractor furnishing all necessary tee-irons for the support of the tile. See details for bulkhead treatment, and iron drawings for the supports.

Provide three-inch (3 in.) tile for the ends of bulkheads where intersected by the entrance doors.

TOILET ROOM FLOORS.—All toilet room floors where shown on plans shall be raised approximately one foot with fireproofing. Supports to be so arranged as not to interfere with the piping of these rooms.

PENT HOUSES.—The contractor shall build the walls of pent houses with four-inch (4 in.) hard or glazed tile, laid up in Portland cement mortar, all joints to be thoroughly flushed up.

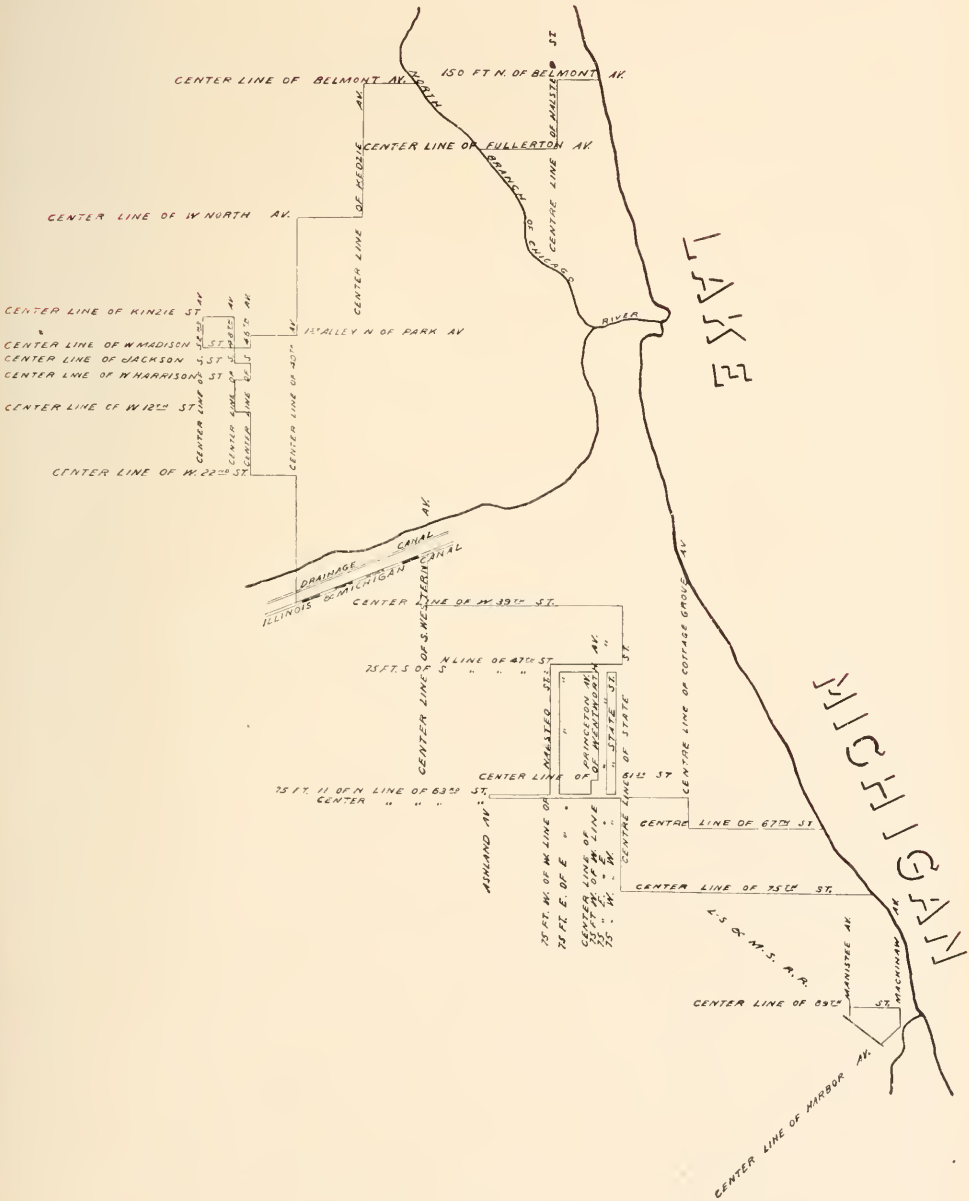
Curbs of all skylights shall be built of four-inch tile.

FLOOR STRIPS AND CONCRETE FILLING.—After the floor arches have been set in place, and at such times as may be designated by the architect, the contractor for carpenter's work will furnish and set the 2x3-inch wood floor strips required as nailing ground for the finished wood flooring, where wooden flooring is called for.

After the strips have been set, the fireproofing contractor must fill in between the same with concrete filling; this concrete is to be composed of one (1) part American Portland Cement, of approved brand, two (2) parts sharp sand, and six parts broken tile, stone, gravel or fine, clean coal cinders, thoroughly mixed together dry, then tempered and mixed, and tamped in place. In no case shall cinder concrete be allowed to come in contact with structural steel.

FINALLY.—Do everything necessary to finish the entire work in a thorough and substantial manner. Remove promptly from the premises all the tools, scaffolding, unused tile, debris, etc., as soon as the work is completed.

PLAT SHOWING THE BOUNDARY LINES OF THE FIRE LIMITS OF THE CITY OF CHICAGO.



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DEPARTMENT OF ELECTRICITY.

CITY OF CHICAGO.

NOTICE.

Particular attention is called to the different sections of the ordinance herein printed:

Permit must be obtained before any work is done.

The use of electric current is prohibited previous to certificate being issued.

Conditions unsafe to life or property must be corrected within forty-eight hours.

Each building must have independent service from street or alley.

Wires must not pass through party walls, over roofs or under sidewalks.

Current must not be supplied from trolley lines for motors or light except for power stations owned by company.

Temporary work must be inspected and approved before current is used.

Alterations to existing wiring must not be made without regular permit.

Permits issued by the Commissioner of Public Works for electrical work to be done on streets must be countersigned by the Department of Electricity.

Violation of any of the Sections of this ordinance constitutes a misdemeanor and renders any person, firm or corporation liable to arrest and fine of not less than $50 or more than $100, also the cutting off and stopping of current used in violation until the provisions are complied with.

William Carroll

City Electrician.

SPECIAL SUGGESTIONS TO ARCHITECTS.

The Department of Electricity will **not allow more than twelve (12) sockets to be attached to one circuit.**

Architects are urged to make definite specifications for electrical work, for the benefit of both the electrical contractor and the fixture contractor, specifying the number of outlets in each job for the electrical contractor to follow, and the exact number of 16-candlepower lamps to be used.

Frequently the fixture contractor installs more than twelve lights on a circuit, which is in violation of the city ordinances, and causes the consumer very much annoyance in getting electric current to his premises.

It is also suggested that the architects demand of the electrical contractor that he make up all connections and combinations relative to switches, complicated outlets, etc., leaving only two wires for the fixture hanger to make his fixture connections.

GENERAL SUGGESTIONS.

In all electric work conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a grounding or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors and securing and attaching of fittings, are especially conducive to security and efficiency, and will be strongly insisted on.

In laying out an installation, except for constant-current systems, the work should, if possible, be started from a center of distribution, and the switches and cutouts, controlling and connected with the several branches, be grouped together in a safe and easily accessible place, where they can be readily got at for attention or repairs. The load should be divided as evenly as possible among the branches, and all complicated and unnecessary wiring avoided.

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The use of the wire-ways for rendering concealed wiring permanently accessible is most heartily indorsed and recommended; and this method of accessible concealed construction is advised for general use.

Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires, and in specifications for electric gas lighting to require a two-wire circuit, whether the building is to be wired for electric lighting or not, so that no part of the gas fixtures or gas piping be allowed to be used for the gas-lighting circuit.

SPECIAL NOTICE.

Place all service switches, meters and cut-outs, when practicable, in basements or public places where they will be readily accessible to inspectors, meter readers and trouble men, in order to obviate the necessity of interfering with tenants of apartments. It often occurs that tenants of apartment buildings who are not using electric current are annoyed by the visits of inspectors and trouble men in their necessary duties in making inspections or repairs for other tenants.

The placing of meters in basements or halls will largely do away with the annoyance caused by their disagreeable humming and it will be much more satisfactory to all concerned.

SECTIONS OF THE REVISED CODE OF THE CITY OF CHICAGO, GOVERNING ELECTRICAL INSPECTIONS.

March 20, 1905.

CHAPTER XXV.—DEPARTMENT OF ELECTRICITY.

807. **Electric Current.**—No electric current shall be used for illumination, decoration, power or heating, except as hereinafter provided.

808. **Application—Contents—Permits.**—All persons or corporations desiring to install wires or other apparatus for the use of electric currents for any of the purposes mentioned in the foregoing section shall, before commencing or doing any electrical construction work of any kind whatever, either installing new electrical apparatus or repairing apparatus already in use, file an application for a permit therefor in the office of the City Electrician, which application shall describe in detail such material and apparatus as it is desired to use, with a full description of the same, giving the locality by street and number; and upon receipt of which application, if found proper, such permit shall be given.

809. **Duties of City Electrician Thereon.**—The said City Electrician shall have power, and it shall be his duty, when by him deemed necessary, to carefully inspect any such installation previous to and after its completion, and it shall be competent for him to remove any existing obstructions which may prevent a perfect inspection of the current carrying conductors, such as laths, plastering, boarding or partitions; and if such installation shall prove to have been constructed in accordance with the rules and requirements of the Department of Electricity, controlling the use of electric current, upon the payment of a fee, as herein provided, he shall issue a certificate of such inspection, which shall contain a general description of the installation and the date of such inspection. Any owner installing or causing to be installed any electric wires to be hidden from view shall, prior to such installation, give said city electrician a reasonable notice in order to give ample time for inspection. The use of electric current is hereby declared to be unlawful previous to the issuance of such certificate; provided, however, the City Electrician may issue a temporary permit for the use of electrical current during the course of construction or alteration of buildings, which permit shall expire when the electrical apparatus for such building is fully installed.

810. **Preliminary and Final Certificate.**—A preliminary certificate may be issued by said City Electrician, in the case of completed installations, but upon which no current

will be used in the immediate future. Such preliminary certificate shall show that at the date of inspection the installation was erected in accordance with the terms of this chapter, and shall be issued at one-half the rates hereinafter named. Prior to the introduction of electric current into the said premises a second inspection shall be made, when, if the said installation is still in accordance with the terms of this chapter, a complete and final certificate shall issue, and the amount of the fee paid for the preliminary certificate shall be deducted from the fee for the final certificate.

811. **Power of City Electrician — Inspections and Re-inspections.** — The said City Electrician is hereby empowered to inspect or re-inspect all overhead, underground and interior wires and apparatus conducting electric current for light, heat or power, and when said conductors or apparatus are found to be unsafe to life or property, he shall notify the person or corporation owning, using or operating them to place the same in a safe and secure condition within forty-eight hours. Any person or corporation failing or refusing to repair, change or remove the same within forty-eight hours, or within such further time as the city electrician shall determine is necessary, after the receipt of such notice, shall be subject to the penalty hereinafter provided.

812. **Poles—Covers—Wires—Electric Service Entrances—Switches.**—All poles now standing or hereafter erected, and all covers for manholes now in service, or hereafter placed in service for the use of electric conductors, shall be branded or stamped with the name of the person or corporation owning the same; all electric service entrances shall have attached to the conductor or conductors, in a conspicuous place, a substantial tag designating the owner, and giving such a full description of the conductors as shall meet with the approval of said City Electrician; and all of said electric service entrances shall be properly equipped with approved cut-out service switches. Each building into which electric current shall hereafter be introduced shall have independent service from the street or alley, entering at right angles with the street curb, except where the service wires are placed in conduits complying with the rules of the department of electricity; and no wires hereafter put up shall pass from one building to another through any party wall or along any building wall or over any roof or under any sidewalk, except where such conduits are used. No electric current shall be supplied from any trolley line for any purpose whatever to any building except for lighting the power stations from which current is supplied to such trolley lines.

813. **Fees.** —There shall be collected by the City Collector, prior to the issuance of certificates permitting the use of electric current, the following fees, in the following manner:

For the inspection of each of the first two arc lamps, one dollar; for each of the next three arc lamps, eighty cents; for each of the next five arc lamps, seventy cents; for each of the next ten arc lamps, sixty cents; for each of the next ten arc lamps, fifty cents; for each additional arc lamp above thirty, twenty-five cents.

Incandescent lamps of nominal 16 candlepower, and for larger or smaller lamps in that proportion, as follows:

For each of the first twenty-five incandescent lamps, ten cents; for each of the next twenty-five lamps, nine cents; for each of the next twenty-five lamps, eight cents; for each of the next twenty-five lamps, seven cents; for each of the next one hundred lamps, six cents; for each of the next one hundred lamps, five cents; for each additional lamp above three hundred, four cents.

For each electrical horse-power of 746 Watts, used for mechanical or other purposes than above mentioned, the sum of one dollar for each horse-power from one to five horse-power, inclusive.

For each of the next succeeding 5 horsepower, seventy-five cents; for each of the next succeeding 5 horsepower, sixty-five cents; for each of the next succeeding 10 horsepower, fifty-five cents; for each of the next succeeding 25 horsepower, fifty cents; for each additional horsepower, twenty-five cents. No inspection shall be made for a less amount than one dollar.

Inspections of temporary installations for show-window exhibitions, conventions and

the like, shall be charged for by the time required for such inspections at the rate of fifty cents per hour.

Each re-inspection of any overhead, underground or interior wires or apparatus, shall be charged for by the time required for such re-inspection at the rate of fifty cents per hour.

ARC LAMPS.

2 arc lamps at $1, $2; above 2 lamps to 5.....at 80 cents each
5 arc lamps, $4.40; above 5 lamps to 10.....at 70 cents each
10 arc lamps, $7.90; above 10 lamps to 20.....at 60 cents each
20 arc lamps, $13.90; above 20 lamps to 30.....at 50 cents each
30 arc lamps, $18.90; above 30 lamps.....at 25 cents each

INCANDESCENT LAMPS.

25 lamps, $2.50; above 20 to 50 lamps.....at 9 cents each
50 lamps, $4.75; above 50 to 70 lamps.....at 8 cents each
75 lamps, $6.75; above 75 to 100 lamps.....at 7 cents each
100 lamps, $8.50; above 100 to 200 lamps.....at 6 cents each
200 lamps, $14.50; above 200 to 300 lamps.....at 5 cents each
300 lamps, $19.50; above 300.....at 4 cents each

MOTORS.

5 horse power, $5; above 5 to 10 horse power.....at 75 cents
10 horse power, $8.75; above 10 to 15 horse power.....at 65 cents
15 horse power, $12; above 15 to 25 horse power.....at 55 cents
25 horse power, $17.50; above 25 to 50 horse power.....at 50 cents
50 horse power, $30; above 50.....at 25 cents

Immediately after the inspection provided for in Section 809 the City Electrician shall make a fee bill, in duplicate, on a form to be approved by the City Comptroller, and shall forward the same to the comptroller to be recorded and rendered. The person or corporation receiving the fee bill shall pay the amount thereof to the city collector, who shall endorse payment thereon, and enter the fee bill to the person or corporation paying the same. The paid fee bill shall then be presented to the city electrician at his office, who shall thereupon issue the preliminary of final certificate, provided for in Section 810.

814. **Alterations.**—No alterations shall be made in any electrical installation without first notifying the said City Electrician and submitting the same for inspection in the same manner as provided for new work.

815. **Penalty.**—Any person or corporation furnishing or using any electric current within the city, in violation of any of the provisions of this chapter, or contrary to any of the rules and regulations of the Department of Electricity, shall be fined not less than fifty dollars nor more than one hundred dollars for each offense, and each day's use thereof contrary to the provisions of this chapter shall constitute and be a separate and distinct offense. Said City Electrician may, for any violation of the provisions of this Chapter, also order and compel the cutting off and stopping of such current until the provisions of this Chapter are fully complied with.

Table of Carrying Capacity of Wires.

Table A. Rubber Covered Wires.		Table B. On Porcelain Knobs—Open Work.	
B. & S. G.	Amperes.		Amperes.
18	3		
16	6		
14	12		19
12	17		24
10	24		32
8	33		43
6	46		57
5	54		63
4	65		74
3	76		83
2	90		98
1	107		117
0	127		140
00	150		157
000	177		185
0000	210		225

Table of Carrying Capacity of Wires.—Continued.

Table A. Rubber Covered Wires.		Table B. On Porcelain Knobs—Open Work.	
Circular Mills.	Amperes.		Amperes.
200,000	200		
250,000			285
300,000	270		355
350,000			377
400,000	330		415
500,000	390		485
600,000	450		545
700,000	500		600
800,000	550		655
900,000	600		710
1,000,000	650		765
1,100,000	690		
1,200,000	730		
1,300,000	770		
1,400,000	810		
1,500,000	850		
1,600,000	890		
1,700,000	930		
1,800,000	970		
1,900,000	1,010		
2,000,000	1,050		

The lower limit is specified for rubber-covered wires to prevent gradual deterioration of high insulations by heat of wires, but not from fear of igniting the insulation. Question of drop is not taken into consideration in above tables.

The carrying capacity of sixteen and eighteen wire is given, but no smaller than fourteen is to be used, except as allowed under Rules 24 *u* and 40 *c*.

Materials.

The following is a list of non-combustible, non-absorptive, insulating materials for the benefit of those who might consider hard rubber, fiber, wood and the like as fulfilling the requirements.

1. Glass.
2. Marble (filled).
3. Slate without metal veins.
4. Porcelain, thoroughly glazed and vitrified.
5. Pure Sheet Mica.
6. Lava (certain kinds of).
7. Alberene Stone.

Electric Gas Lighting.

Where electric gas lighting is to be used on the same fixture with the electric light:

No part of the gas piping or fixture shall be in electric connection with the gas lighting circuit.

The wires used with the fixtures must have a non-inflammable insulation, or, where concealed between the pipe and shell of the fixture, the insulation must be such as required for fixture wiring for the electric light.

The whole installation must be test free from "grounds."

The two installations must test perfectly free from connection with each other.

816. **Electric Lighting Facilities Indemnity.**—The city electrician is authorized to execute and deliver in the name of the city of Chicago to any person or corporation affording facilities for any of the city's electric lighting property, contracts of indemnity to hold such person or corporation harmless from all injuries, damages or expense to any persons or property arising in any way out of the city's exercise of such facilities, when such facilities are not afforded under the requirements of ordinances held by them.

818. **City Electrician in Control.**—The City Electrician shall have charge and control of and shall erect all lamp posts and lamps, and street signs designating the names of the streets which shall be placed on said lamps.

REGULATIONS GOVERNING CHICAGO EDISON COMPANY'S SYSTEM.

INSPECTION.

All wiring which is to be connected to the mains of this Company must be installed in accordance with the rules and requirements of the Department of Electricity of the City of Chicago and the Chicago Underwriters' Association. A "certificate for installation" or "temporary current permit" from said Department of the City must be presented at the office of the Inspection Department of this Company before current can be used on any wiring for which such certificate or current permit has not been issued. When wiring has been installed for additional lights or power, this certificate or current permit must also be presented as in the case of an original installation. The Company should be notified whenever any additional apparatus is desired to be connected to consumer's wiring in order to avoid interruption of consumer's service and injury to the Company's meters or other apparatus. The Company will make the final connection of all wiring to its mains.

DIRECT CURRENT TERRITORY.

Current is supplied from the Edison three-wire direct current system in approximately the following territory:

South of Menomonee Street east and north of the Chicago River.

West from the Chicago River to Morgan Street between Kinzie Street and Twenty-second Street, except on Milwaukee Avenue, where the direct current extends to Wood Street; on West Madison, where it extends to Loomis Street, and on Blue Island Avenue, where it extends to Throop Street.

In the "down town" district. On the south side to Thirty-fifth Street between Stewart Avenue and Cottage Grove Avenue.

From Thirty-fifth to Thirty-ninth between Dearborn Street and Grand Boulevard, and on Cottage Grove Avenue from Thirty-fifth to Thirty-eighth Streets.

ALTERNATING CURRENT TERRITORY.

Current is supplied from the alternating current Edison three-wire system for lighting and small power in all parts of the City, other than those above described, where the Company has lines.

Current is supplied for power from the three-phase system in a large part of the alternating territory, but inquiry should be made of the Inspection Department at the nearest district office as to the proximity of three-phase lines to any particular location where power may be desired.

SERVICES.—UNDERGROUND.

The consumer's wiring must be extended to the Company's nearest service where sidewalks are excavated and provided with the necessary service switch and cut-outs, unless the premises in which current is to be used are more than 50 feet from the nearest service. In this case, application should be made to the Company to have a service installed.

In case it is necessary to extend service inside of the property line in order to reach the building, the expense of the installation of the portion inside the property line must be borne by the consumer. Final connection of the wiring to the service will be made by this Company in all cases.

OVERHEAD.

The consumer's wiring must be brought outside the building wall at some point at least 25 feet above the ground, so located that it will be readily accessible to service wires brought from the Company's nearest pole. In case the pole line from which service is to be given is not in position at the time interior wiring is being done inquiry should be made at the district office for information as to its proposed location.

Inside wiring must not be brought out of the building in an inclosed air shaft, as the City ordinance forbids the erection of wires across a roof to reach wires in such a place.

The location of service outlets on a party wall is also forbidden by City ordinances.

ALTERNATING CURRENT MOTOR AND ARC LAMP.

On the alternating current system, separate services will be provided as follows:

For motors of one horse-power or larger and for arc lamps where a large installation is made.

Inquiry should be made of the Inspection Department in all cases where more than ten alternating arc lamps are being wired, as to whether incandescent and arc lamps may be wired to the same service.

Separate mains and meter loops are of course necessary for all wiring fed by separate services.

METERS.

Meter loops must be provided in the mains at an accessible point, and so arranged that the meter may be mounted with ordinary wood screws on the wall. A meter board must be provided of sufficient size to allow the installation of a recording watt meter and maximum demand meters. Two demand meters are installed on three-wire mains. Sufficient space must be provided about the meters to allow the removal of the case. Meter loops should not be placed above seven feet from the floor.

In office buildings meter loops should be located at a central point in meter closets or public corridors, and in apartment buildings in the basement of the building, so that meters may be installed and maintained without annoyance to tenants.

MOTORS.

Wiring for motors should be so arranged that the current used for power purposes may be metered separately from that used for lighting. Wiring for elevators should also be arranged so that current used on elevators may be metered separately from that used for other power.

All motors larger than 1 horsepower must be wound for 220 volts, and it is preferred that motors of three-fourths horsepower and larger be so wound.

Alternating current motors must be designed to operate at a frequency of 60 cycles.

No motors larger than 5 horsepower will be supplied on single-phase system, except by special permission, given by the Inspection Department of the company in each case.

Motors of 5 horsepower and larger will be supplied on the three-phase system at 60 cycles, 220 volts.

No motor will be connected which requires more than three times full load current in starting without load.

INCANDESCENT LAMPS.

Standard shape Edison base incandescent lamps will be furnished free of charge for installations and renewals, unless otherwise provided for by the terms of the contract, in 4, 8, 10, 16, 24, 32 and 50 candle-power sizes.

One lamp will be furnished for each socket installed in the customer's premises at the time the installation is made. Additional lamps will be furnished at any time when additional sockets have been wired. A reserve supply of lamps, equal to approximately 10 per cent of the customer's total installation, will be advanced for convenience in making renewals. When burned out or blackened, lamps will be renewed free of charge (except special lamps) upon presentation of the old lamps with glass intact at the nearest lamp renewal station.

All lamps furnished for installation, reserve or renewal remain the property of the company. The consumer must, therefore, give his receipt for all lamps delivered to him for installation, reserve or renewal, agreeing to pay for lamps unaccounted for at 20 cents each.

ARC LAMPS.

Arc lamps having a standard black finish are provided by the company for the consumer's use free of charge. Lamps having ornamental finish will be supplied only at an extra charge.

Lamps furnished by the company will be cleaned and trimmed by the company free of charge when used for general lighting purposes. Arc lamps used for photographing or other purposes than general illumination must be provided and maintained at the consumer's expense. A hanger board must be provided for use in hanging inside lamps and a suitable crane provided with a hook must be provided for outside lamps. They must be installed so that the bottom of the lamp will not be less than eight feet above the ground when it is hung, the length of the lamps being about 40 inches. If it is necessary to install lamps beyond the reach of a six-foot step-ladder, some arrangement must be made for lowering the lamp so that it may be trimmed.

See section on "Services" for special regulations regarding alternating arc lamps.

GAS FITTERS' RULES.

OFFICE BUILDINGS, DWELLING HOUSES AND FLATS.

MANUFACTURED GAS FOR LIGHT.

The following tables show the proportionate size and length of tubing allowed:

Size of Tubing.	Greatest Length Allowed.	Greatest Number of ¾" Openings Allowed.	Size of Tubing.	Greatest Length Allowed.	Greatest Number of ⅜" Openings Allowed.
⅜ inch	20 feet	2 openings	1½ inch	150 feet	60 openings
½ inch	30 feet	3 openings	2 inch	200 feet	100 openings
¾ inch	60 feet	10 openings	2½ inch	200 feet	200 openings
1 inch	70 feet	15 openings	3 inch	300 feet	300 openings
1¼ inch	100 feet	30 openings			

Drops in double parlors, large rooms and halls of office buildings must not be less than ½ inch.

STORES, HOSPITALS, SCHOOLS, FACTORIES, ETC.

MANUFACTURED GAS FOR LIGHT.

Size of Tubing.	Greatest Length Allowed.	Greatest Number of ½" Openings Allowed.	Size of Tubing.	Greatest Length Allowed.	Greatest Number of ½" Openings Allowed.
½ inch	20 feet	1 opening	1¼ inch	100 feet	20 openings
¾ inch	60 feet	8 openings	1½ inch	150 feet	35 openings
1 inch	70 feet	12 openings	2 inch	200 feet	50 openings

For stores the running line to be full size to end of last opening.
All drops to be ½ inch with set not less than 4 inches.
Twenty feet of ⅜-inch pipe allowed only for bracket lights.

BUILDING SERVICES.

In running service pipe from front wall to meters the following rules will apply:

Size of Opening.	Greatest Length Allowed.	Greatest Number of ¾" Openings Allowed.	Size of Opening.	Greatest Length Allowed.	Greatest Number of ¾" Openings Allowed.
1 inch	70 feet	1 opening	1½ inch	150 feet	5 openings
1¼ inch	100 feet	3 openings	2 inch	200 feet	8 openings

All openings in service must be equal to the size of riser, which in no case must be less than ¾ inch.

MANUFACTURED GAS FOR FUEL.

Size of Tubing.	Greatest Length Allowed.	Greatest Number of ¾ Openings Allowed.	Size of Tubing.	Greatest Length Allowed.	Greatest Number of ¾ Openings Allowed.
¾ inch	50 feet	1 ¾-in. or 2 ½-in.	1½ inch	150 feet	7 or 4 ¾-in. and 6 ½-in.
1 inch	70 feet	2 or 1 ¾-in. and 2 ½-in.	2 inch	200 feet	15 or 8 ¾-in. and 14 ½-in.
1¼ inch	100 feet	4 or 2 ¾-in. and 4 ½-in.			

For mantels, grates and small heating appliances, for heating space not to exceed 1,728 cubic feet, thirty feet of ½-inch pipe is allowed for one opening only, and two such openings are considered as one ¾-inch opening.

FOR GAS ENGINES.

Size of Engine.	Size of Opening.	Greatest Length Allowed.	Size of Engine.	Size of Opening.	Greatest Length Allowed.
1 H. P.	1 inch	60 feet	7 H. P.	1½ inch	100 feet
2 H. P.	1¼ inch	70 feet	12 H. P.	2 inch	140 feet
5 H. P.	1½ inch	100 feet			

Supply for gas engine must be separate, and an independent service will be required.

NATURAL GAS FOR FUEL.

Classification of Appliances.	Size of Openings.	Greatest Length Allowed.
Small portable gas cooking stove	½ inch	20 feet
Small portable gas heating stove	½ inch	20 feet
Kitchen boiler heater when separated from range	½ inch	20 feet

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MICHIGAN AVENUE AND ADAMS STREET.

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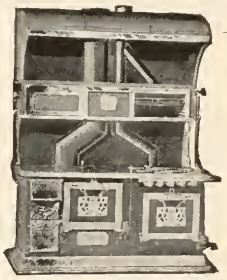
Information in reference to the use of Gas for Special purposes will be gladly furnished at the office of the Company.



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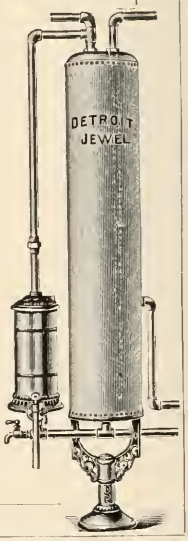

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Miscellaneous appliances consuming 40 to 75 cubic feet of gas per hour	1 inch	60 feet

For special purposes not provided for above, apply to the company's inspector for information.

SUMMARY.

1. All branches or cross lines of pipe from the main line must have a set not less than 4 inches dropped square, and must be well secured to joist by gas hooks or straps.

2. All openings must be closed with iron caps, no split pipe or broken fittings repaired with cement or lead will be allowed.

3. All drops on branch lines and openings for side brackets must be square bends; no nipples allowed.

4. The risers in all buildings must be carried up an inside partition out of reach of frost and must be placed where the meter and stop cock can be readily got at. Vestibules not to be considered as inside partitions.

5. To avoid trapping, gasfitters must grade all pipes to riser or drops.

6. In no case will a meter be set where it is not easily accessible, or where it is exposed to frost and dampness, or liable to injury from any cause.

7. All pipe for fuel must be run independent, and connected to light riser at meter end, with right and left, union, or running thread.

8. Supply for gas engines must be separate, and an independent service will be required.

9. Drops in churches, schools, public halls, stores, double parlors, large rooms, etc., must not be less than ½ inch.

10. No riser in any building must be less than ¾ inch and in stores must not be under deck of show windows, as meter will not be set there.

11. The riser in any building must not be less than 20 inches from the floor for two to ten openings; 2 feet 6 inches for ten to thirty openings; 4 feet for thirty to sixty openings; 5 feet for sixty to one hundred openings; 6 feet for over one hundred openings.

Where meters are to be set on wall, no riser must be higher than 9 feet from floor.

12. In all cases where extensions are made, care must be taken to break pipe where the rule for size can be maintained, and in no case shall extension be made from small pipes.

13. In flat buildings meters should be set in basement or in room provided for meters; otherwise in premises where gas is consumed.

14. All risers and building services must be brought to front of building and within 18 inches of wall or partition, and must not be less than 15 inches apart where risers are grouped.

15. In all cases where building service is used, provide header with an opening for each riser; where risers are in groups, openings must not be less than 15 inches apart.

16. Underground work by gasfitters between main and meter will not be allowed or accepted.

17. To avoid complications, gasfitters should consult this Company before locating risers in corner buildings.

18. In flat buildings where appliances are installed for the joint use of tenants, such as laundry stoves, driers, etc., run pipe from each meter to laundry and provide a header for a lock cock for each tenant. Fasten securely to each cock a metal tag with the flat number plainly marked thereon.

In cases where one common riser is desired, locate header in laundry and provide lock cocks and tags as provided above.

19. All work must be proved with mercury gauge, not less than a 6-inch column of mercury being allowed.

20. All pipe must be examined by the inspector of this company before being concealed, and twenty-four hours' notice must be given by gasfitters when any pipe is ready for inspection.

21. If the rules concerning the size of pipes are not clearly understood in each case, or if unusual conditions are met with, which the rules do not cover, communicate with the company's inspector.

22. It is the purpose of the company to strictly enforce the above rules, and no certificate of inspection will be given when they are not complied with.

23. Architects, builders and owners of buildings are requested not to allow a bill for gasfitting unless accompanied by a certificate of inspection.

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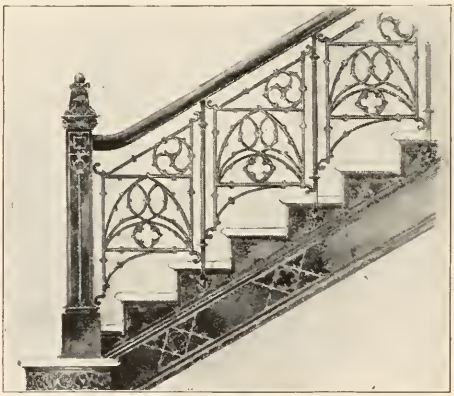

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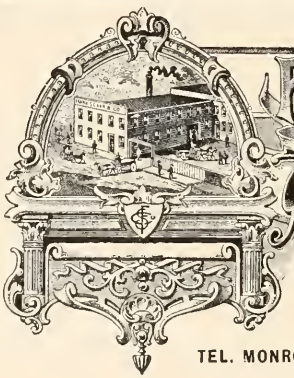

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MODERN STEEL CONSTRUCTION.

By Frederick Baumann, A. I. A.

In theory, steel is a chemical combination, or iron with a limited amount of carbon. But in practice there are quite a number of such combinations, though but very slightly differing in the proportion of the elements combined, slightly, yet materially, as to the attained quality of the product. Iron may be classed as a universal mineral, as the mineral for mankind which has been most prominent in the advance of its civilization. Our age is the age of steel and will remain that until the difficulties are removed which as yet prevent the use of a common method in reducing clay to its metallic constituent. When that is done the age of steel will be transferred into the age of aluminum, and a still "brighter" day will arise. But let us be patient.

Iron is but a common metal, it may be said—a very common one. Every other metal in ordinary demand may readily be said to be superior to it in a number of qualifications. It cannot and need not fill all demands, yet it fills more than do all the other metals combined. It fills a profuse number of requirements with superabundant readiness and ease; others, referring to tools and implements, even to fine art, with subtleness and grace. It is found everywhere in the entire world, and civilization proper is unthinkable without the presence of iron.

Iron is known to be one of the most common chemical elements in existence. It can be readily combined with a number of others. Its affinity for oxygen and for sulphur is very great. It readily corrodes. Iron fabrics are destroyed by rust if not especially protected. In fact, rust is to iron a symbol of death. But while oxides of iron found in nature are easily reduced to the metal, sulphates of it are not. Sulphur appears to be iron's worst enemy. Even a trace of it depreciates its quality, and full-fledged combinations of iron and sulphur are thus far used mainly for a production of sulphuric acid.

Another element most injurious to the quality of iron is phosphorus. Even the minutest admixture of it renders the iron brittle. But phosphorus makes it more liquid in melting, and to this property the fine little Berlin castings, once so celebrated, owe their existence. No iron is found wholly free from an admixture with silica, and traces of it to a certain extent are judged to be an improvement in its quality. Other ingredients may be said to be more or less harmless. One element, however, is the real factor which imparts to iron the very conspicuous quality of being the practical king of metals. This factor is carbon. The softest, most malleable iron contains but traces of it, by reason of it being artfully reduced from proper castings. These castings may contain from one to three per cent of carbon chemically combined, besides several per cent of it merely admitted. This admixture gives to the product a grey tint, hence its name, grey iron, which is usually obtained. Exceptionally, however, the castings are an out-and-out chemical compound of iron and carbon. This product appears white, and, because it is glossy, it was in Germany called spiegeleisen (mirror-iron). It contains somewhat like seven to eight per cent of carbon, and this overcharge of carbon in it has led to an invention by which an unprecedented stir was produced in the entire domain of industry. I refer to

THE BESSEMER PROCESS.

Steel contains from 0.5 to 1.5 of carbon. It is either made from the purest of malleable iron by means of expressly carbonizing it, or it is made from a very pure kind of cast iron by the peculiar process of puddling. Hence the distinction between cement steel and puddle steel. This two-fold distinction held good till the end of the fifties of the past century, when Bessemer had succeeded in manufacturing an entirely new kind, the ingot steel, which by the world is generally called by the name of its inventor. Common cast iron contains from 2 to 3 per cent of carbon, chemically bound in, and about an equal though varying amount of carbon merely admixed. It

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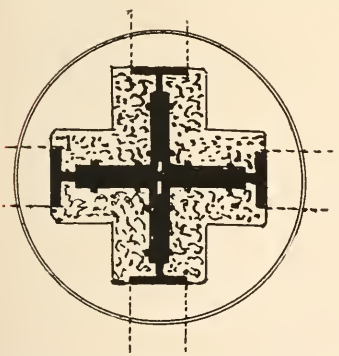
was the task to reduce all this to about one-half of 1 per cent, to destroy as far as possible all harmful ingredients, such as phosphorus and sulphur, and to do all this by one brief process. This task called for a good deal of thinking, for unbounded faith, and for an outlay of much money. The result is known. The industrial world has advanced.

Although the kind of steel thus obtained by pouring molten raw iron into a converter, burning out its carbon and impurities by blowing heated air through it, and then replenishing the proper amount of carbon for making steel by adding a proportioned bulk of spiegeleisen—although this kind of steel is not of a high grade, it nevertheless has served to open a new era in iron industry. All railway and tramway tracks were at once made of such ingot steel, and also all beams and almost all posts used in every building construction. When the first iron beams were introduced some 50 years ago, they were high in price and for a number of reasons the demand was limited. Then followed, in the sixties, the introduction of the ingot-steel beams, plates, angles, crosses and the like in many hundreds of forms, and lastly to a general length of 60 feet. A desire grew up with builders to erect permanent edifices on prominent grounds in large cities as high as safe construction would permit. And since the deed is offspring of the wish, it would soon follow that some architect conceived the idea of omitting all walls for a building by making it of steel construction throughout. Hence, our tall and tallest buildings. They are intended to be fireproof. But are they in fact? All conflagrations which have thus far taken place have plainly said: No, they are not. But they ought to be. Here is room for the thinking architect. A happy result appears not to be beyond question.

As to the columns for a tall building, it appears to be evident that they never should be of cast iron, which permits of but loose connection from story to story. They should be of steel, reaching, as it were, in one length from cellar to roof. They should never be built so as to inclose hollow spaces, in which the irons are left bare, to rust and decay. The inclosure should be compact and solid.

In order to give a somewhat positive idea of the manner of properly composing a steel column, I add the following sketch, which shows a cross section of it. The column consists of an I-beam, two T's and four angles properly riveted and joints broken as required, and dimensions proportioned to loads to be carried. There can be no trouble in demonstrating these, inclusive of thicknesses, from cellar to roof. Four faces are offered for attaching girders and beams, so that crossing plates are avoided, to the advantage of a more rapid construction. Girders and beams, of course, may be attached in the usual way. The enclosing tile to be of a peculiar form, as indicated on the sketch. Two inches thick beyond the extreme iron faces ought to be ordinarily sufficient, but another encircling course of tiling should be added to suit business requirements. The inner space to be filled, solid, from time to time while the work is proceeding, with proper cement grout so that no hollow space can be left at any place. By so doing the irons will be fully protected against the corrosive agency of the all-pervading atmosphere.



Writing on the characteristics of the metal, Mr. Robert W. Hunt, C. E., says:

"The use of steel in building construction of practically all kinds has become so general, that the character of the metal employed deserves most careful consideration. It is no safer to assume that steel is steel than to accept as reliable material any cement offered simply because it is designated as 'Portland.'

"Cast iron was the first metal used by builders, and even yet is playing a conspicuous part; but its limitations were soon proven, and late experiences tend to render them still narrower. On the other hand, the use of "wrought" or elastic metal,

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first iron, and later steel, has constantly progressed; such severe tests as the Baltimore fire serving to increase confidence in it. Many years ago the disastrous collapse of cast iron columns in a Massachusetts cotton mill illustrated the necessity of care in casting such members, as well as in the selection of the metal used.

"While fortunately steel is an easy metal to manipulate, and the developments of metallurgy have made it a cheap one to produce, it is at the same time most sensitive to treatment, particularly heat treatment, so that, no matter how superior the metal may be from a chemical standpoint, it can be made worthless by careless workmen; and, unfortunately, such negligence may not leave any surface indications of the damage done. At the same time, its chemical constitution should not be disregarded, particularly as the percentage of certain elements are increased, so does the liability to damage in manipulation.

"Many years ago Mr. William Metcalfe, in a contribution to the proceedings of the American Institute of Mining Engineers, described a simple, and at the same time comprehensive, experiment illustrating the effect of heat on steel, and it is one which almost anyone can make for themselves. To one who is not familiar with the subject the results will certainly be surprising. It is: Take an inch square bar of steel of any grade, and at distances one inch apart have nicks made by a cold chisel; then insert the bar in an ordinary blacksmith's fire, and bring the end farthest in the fire up to a bright yellow heat. Withdraw the bar and allow it to slowly cool. When cold, break it by blows of a hammer at each nick, and it will be found that the fractures will clearly indicate the degree of heat to which the bar had been subjected at each point. The extreme end of the bar, having been exposed to the highest heat, had become the hottest, the temperature diminishing as the limits of the fire were reached. The fracture at the nick nearest the end will be the coarsest in grain, which condition will decrease at each nick in proportion to the heat to which the steel had been subjected, until the comparatively cold metal has been reached, where there will not have been any change produced. Of course, the finer the grain of the steel, the greater its tensile strength; and the higher the percentage of carbon which it contains the more will it be affected by heat treatment.

"Now supposing that, instead of permitting the bar of steel to become cold after heating it, work had been put upon it, by either hammering or rolling; it would have been found that the coarsing effects of the heating had been overcome, and in many cases the grain of the bar made even finer, and hence stronger, than it was before the operations. But if the heating had been raised to a degree higher than that particular grade of steel would bear, no matter how much subsequent work was put upon it, the damage could not have been overcome.

"The increased use of steel would have been impossible had not its cost been greatly reduced through the discovery and development of new processes of manufacture, permitting its rapid production and manipulation in large masses. The first and most revolutionary one of these was the Bessemer, referred to above by Mr. Baumann.

"In time the Thomas-Gilchrist invention was perfected. This requires the converter to be lined with a basic material, so that the slag will be basic, and by the addition of more lime, the phosphorus can be drawn from the iron to the slag, and thereby ores much higher in phosphorus are available. This is known as the Basic Bessemer process.

"But while the iron may be, in fact, must be, high in phosphorus, as the reduction of that element is depended upon to furnish the necessary heat for the process, the silicon percentage in the iron must be low, or its reduction would be disastrous to the basic lining of the converter, and otherwise render the operation impractical. So that here again only certain iron ores can be used. And as they are not plentiful in this country, the Basic-Bessemer process has not been financially successful in America, while it has been so in Europe.

"Following Bessemer's invention came those of Martin and Siemens, known as

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acid open hearth steel, because the furnaces in which it is produced, while having a lining different from that used in the acid Bessemer converter, it nevertheless produces an acid slag.

"The Thomas-Gilchrist basic lining was applied to open hearth furnaces, and the basic open hearth steel process developed. By this process, phosphorus can be eliminated, and as the range of suitable metal is much greater than either of the other named processes, its development, particularly in this country, has been very rapid, and is still progressing.

"Reference has been made to the necessity for careful treatment, both in the manufacture, manipulation and fabrication of steel. While this is so well known, it is doubtful if sufficient attention is always given to it, and proper steps taken to prevent bad work. It is much easier to conduct fabrication in a loose manner, and if two holes do not come fairly opposite each other, drive in the drifting pin, and slam away until the rivet or bolt can be forced through. Treat the metal as though it were its fault that so much brute strength had to be expended. But what about the ruptures in the material which may be started? What about the strains set up, etc., etc.? And has any money been saved? A business conducted on careful, systematic lines is certain to be more profitable in the long run than one run on the slam-bang plan.

"Steel is a good, honest metal under good, honest treatment, but, like human nature, it resents the opposite, and frequently repays in kind."

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Carnegie says: "The subject of fireproof construction is steadily growing in importance. The need of fireproof buildings in the business centers of our great cities has been well demonstrated, and their superiority has become so generally recognized that at present but few structures of any size or importance are designed which are not more or less of this type. This change has been facilitated in no small measure by a number of signal improvements made of late in the art of fireproof construction, insuring not only a higher degree of efficiency, but a considerable reduction in cost compared with methods formerly practiced.

"The old style of solid brick arch, once so prevalent in floor construction, has been almost wholly supplanted by the more modern forms of hollow tile and terra-cotta arches. Roofs, ceilings and partition walls are now also largely constructed of these light refractory materials.

"The substitution of steel for iron in beams may be cited as a radical improvement in this direction, and, simultaneously, the introduction of new patterns for steel beams.

"Another change which is gradually taking place is the substitution of steel for cast iron in the composition of columns. Cast iron is a material so uncertain in character that its use has long since been abandoned in bridge construction. In buildings the loads are generally quiescent and the liability to sudden shocks is more remote than in bridges; yet, on the other hand, the columns seldom receive their loads as favorably as in bridges; in most cases there exists considerable eccentricity, that is, the loads on one side of the column are heavier than those on the other side, and the bending strains arising therefrom increase the strains from direct compression materially.

"The following are some of the contingencies which may arise in the manufacture of castings and which preclude anything approaching uniformity in the product.

"In the case of hollow cast iron columns, while the metal is yet in a molten state the buoyancy of the central core tends to cause it to rise, thereby reducing the thickness of the metal above and increasing it below. When columns are of such a length as to make it necessary to pour the metal into the mold from both ends, it sometimes occurs that the iron becomes too much chilled on the surface to properly mix and unite, thus creating a weak seam at the very point where the greatest strength will be needed. The presence of confined air, producing "blowholes" and "honeycomb,"

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and the collection of impurities at the bottom of the mold may be further mentioned as frequent sources of weakness in cast iron.

"The most critical condition, however, is that due to the unequal contraction of the metal during the process of cooling, thereby giving rise to initial stresses, at times of sufficient force to produce rupture in the column or in its lugs on the slightest provocation. In many cases the trouble can be ascribed to faulty designing or carelessness in the execution of the work, yet even under favorable conditions it is so difficult to secure equal radiation from the molds in all directions that castings entirely exempt from inherent shrinkage strains are probably seldom produced.

"As a protection against these contingencies resort must be had either to the crude and uncertain expedient of a high safety factor, not less than 8 or 10, or a material such as rolled steel must be adopted of a more uniform and reliable character than cast iron.

"Steel columns fall either by deflecting bodily out of a straight line, or by the buckling of the metal between rivets or other points of support. Both actions may take place at the same time, but if the latter occurs alone, it may be an indication that the rivet spacing or the thickness of the metal is insufficient.

"The rule has been deduced from actual experiments upon wrought iron columns, that the distance between centers of rivets should not exceed in the line of strain sixteen times the thickness of metal of the parts joined, and that the distance between rivets or other points of support at right angles to the line of strain should not exceed thirty-two times the thickness of the metal.

"As it is impracticable to repaint the inner surfaces of columns, they should preferably be used only for interior work, where the changes in temperature are not considerable and the air is comparatively dry. In places exposed to extremes of temperature and unprotected from the rain, the paint on the inner surface of the column will, sooner or later, cease to be a protection; corrosion will set in, and, once begun, is apt to continue as long as there is unoxidized metal left in the column.

"The length of a column unbraced should not exceed 125 times its least radius of gyration."

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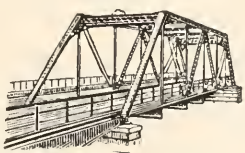

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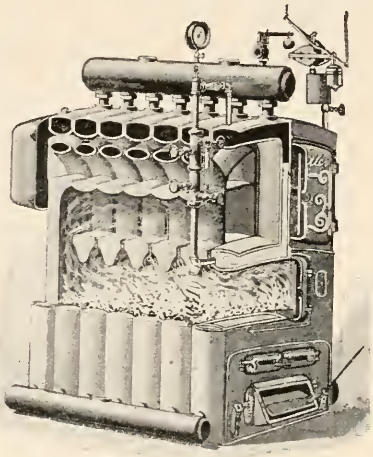

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HOT WATER HEATING.

Heating by water or the vapor of water, i. e., steam, is accomplished in many ways, and has been utilized for the comfort of humanity for many years, and of late years is used exclusively for large buildings and almost universally for the modern homes and apartment buildings. The use of hot water for heating purposes is interwoven with the history of Rome, though it has become a commercial proposition within the last thirty years, and to-day in the United States there are millions of dollars invested in factories and machinery for the production of apparatus for this purpose. When what may be called the modern hot water heating apparatus was introduced in 1875, it was considered good practice to run a separate pipe from the top of the boiler to each radiator, with a corresponding return pipe from each radiator to the bottom of the boiler. Where this system was put in with pipes properly proportioned relative to their length the circulation was perfect. However, the cost of such an apparatus was very high and led to the introduction of what is known as the two-pipe system, which is still highly recommended by some of the best heating engineers. About 1890 what is known as the one-pipe system was introduced, and as it could be installed at a much lower cost it has gained popularity and is used extensively. The overhead system, otherwise known as the Perkins system (though in the opinion of the writer should be credited to Mr. Mills of Boston), probably antedates the systems referred to above, but is used oftener under conditions that will not permit the use of the other systems mentioned, rather than from choice. Another system is referred to only that its use may be avoided. This system is known as the pressure system, and as its pressure is obtained by what is known as safety valves set so that a given pressure may be carried before they will open, it is considered dangerous and is not recommended by the best engineers. As a matter of fact, few, if any, accidents have ever happened to a hot water heating apparatus that have not been caused by undue pressure due to freezing of the open vent pipe or the safety valve failing to operate. The pressure system, owing to the fact that it may be installed cheaply, has a few advocates. With this system smaller radiators may be used, as under pressure a greater range of temperatures may be had. The advantages of the hot water apparatus are, however, practically all lost, as the friction incident to the circulation of the water through small pipes does away entirely with economy of operation, which, after all, is of much more consequence than low first cost.

Hot water heating apparatus cannot be too generous in its proportions, as low temperatures depend upon the size of the radiators, and slow combustion depends upon the size of the boiler. Slow combustion means economy. Comparing size of radiators with those of the steam apparatus, they should be at least as 8 is to 5, that is to say, that a radiator for hot water for a given space should be three-eighths larger than one for steam to heat the same space. It should be understood, also, that all hot water apparatus is always under pressure to the extent of the height of the column of water, one pound pressure for every 27 inches of height of the column.

In the open tank system the basement piping consists of supply and return mains of the same size running parallel or with return directly under the flow pipes and pitching upward from the boiler. What is known as the trunk system consists of one supply and one return main of equal size. These are run in pairs and each radiator has supply and return of same size.

Each radiator has a valve and union ell at the opposite end of it. If one main only is used the radiators on first floor should be supplied direct and should have larger connections. Radiators on the second and upper floors can be supplied from one branch. The ends of supply and return should be larger than the supply riser.

To find the size of mains multiply the radiating surface: When 1,800 feet and less, by .011; when 2,000 feet and over, by .009.

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Size of Main.	Area.	Direct Radiation Will Supply, Feet.	Indirect Radiation Will Supply, Feet.
1½ inches	2.03	200	135
2 inches	3.35	325	200
2½ inches	4.78	450	300
3 inches	7.38	700	450
3½ inches	9.82	900	600
4 inches	12.73	1200	800
4½ inches	15.93	1500	1000
5 inches	19.99	2000	1200
6 inches	28.88	3000	2000
7 inches	38.73	4200	2800
8 inches	50.03	5600	3600
9 inches	63.63	7000	4600
10 inches	78.83	8500	5600

In the case of water being used, an expansion tank is necessary, for as the temperature of water rises until at the boiling point it is 5 per cent. greater than at 40 degrees the increase must be provided for, so that when cooled the system will still be full of water. It should be placed at a point above the highest radiator, the supply and return to it being connected to the supply and return of the nearest radiator, at a point below the radiator connection. No valves should be placed at any point that can possibly close the connection between the boiler and the tank.

To find the size of tank in gallons required, multiply the square feet of surface in the radiators, if the amount is less than 1,000 square feet, by .03; between 1,000 and 2,000 square feet., by .025; over 3,000 square feet, by .02.

An altitude gauge placed near the boiler will save watching the expansion tank. Fill the expansion tank to a point half way up the glass, and set the red hand of the gauge to indicate that point, and the movement of the movable hand will indicate the relative position of the water in the tank.

In the matter of radiation, the surface required is most important. In all cases the radiators should be placed as near the windows or outside exposures as possible. Low and curved window radiators add to the cost. Conditions vary considerably and must enter into the calculations of amount of radiation necessary. Glass exposure, wall expose, cubic contents, location, exposure and construction of building must all be taken into account.

Ascertain the dimensions of room, the number of square feet of glass surface in windows and outside doors, figuring these doors as if glass, and measuring the entire opening of windows and door-frames. Ascertain the square feet of exposed wall surface. and deduct the glass surface as obtained above, and this will be the net amount of wall exposure. Reduce the wall surface to the equivalent of glass surface by dividing the net amount of wall exposure by 10 if the wall is from 8 to 10 inches thick, by 15 if from 12 to 26 inches thick, and by 20 if the wall is 26 to 38 inches thick. This result, added to the glass exposure, gives the glass equivalent of the glass and wall exposure. Multiply this glass equivalent by 75 (the cubic feet of air that each square foot of glass will cool per hour), and the product is the cubic feet of air to be heated to overcome the cooling effect of the glass and wall exposure. Now add to this the cubic contents of the room, and we have the total quantity of air to be heated.

It is customary to guarantee a temperature of 70 degrees in zero weather. To arrive at the amount of radiation under this guarantee multiply the quantity of air to be heated by the decimals given below, and the product will give number of feet required.

In localities where the temperature falls below zero, add to the amount of radiation obtained 1 per cent. for every degree below zero.

For Hot Water.—For temperature of water in radiators, 160 degrees, multiply by .0092; water in radiators, 170 degrees, multiply by .0081; water in radiators, 180 degrees, multiply by .0072.

For water use the multiple .0092; for if water is 175 degrees in flow and 145 degrees in return, the average is 160 degrees in radiation.

This is based upon using direct radiation, and provides for one change per hour. For more frequent changes increase the cubic contents by as many times as it is desired to change the air, the multipliers remain the same.

Direct radiation is surrounded by warm air, but cold air comes in contact more or less with their surfaces, in direct-indirect and indirect systems, so that for direct-indirect add 25 per cent. and for indirect 50 per cent.

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EXAMPLE FOR DIRECT RADIATION.

Room— 16 feet wide, 20 feet long, 10 feet high.
4 windows, 3 feet wide, 5 feet high.
2 sides of room exposed to 0° weather.
10 inches thickness of wall.
$16 \times 20 \times 10 = 3200$ cubic feet of air in room.
$3 \times 5 \times 4 = 60$ square feet of glass in windows.
$16 + 20 \times 10 = 360$ square feet of wall surface exposed, including glass.
$360 - 60$ (glass) $= 300$ square feet actual amount of exposed wall surface.
$300 \div 10 = 30$ — glass equivalent in wall exposure.
$30 + 60 \times 75 = 6750$ — air in cubic feet cooled by windows and walls.
$3200 + 6750 = 9950$ — total in cubic feet of air to be heated.
$9950 \times .0055$ (multiplier for steam) $= 54.72$ radiation in square feet required to heat room.

Indirect radiation is adopted where a large amount of ventilation is desired. It is particularly necessary in schools, hospitals and churches, and in dwellings one or two indirect stacks are desirable. This method of heating is decidedly more expensive than all direct radiation, and consumes more coal. It is frequently used in combination with direct radiation, and in this case ventilating flues must be provided. Either fireplaces or special flues from each apartment so warmed to the open air, and these flues (as well as from those conducting heat) must be placed in inside walls or partitions.

In installing this system the heating stacks are placed in the basement, connected to main supply and return pipes and encased with either galvanized iron, or narrow ceiling lined with tin. The cold air is introduced through air ducts from the outside, and after being warmed by contact with the indirect heating surfaces, is introduced into the rooms through tin flues and registers.

STEAM HEATING.

Steam heating has formerly been divided into two classes, high pressure, low pressure. High pressure steam heating is a system of the past except in very ancient and isolated cases. High pressure steam has to do now almost entirely with power. Such steam from the power plant as is used for heating purposes first passes through a pressure reducing valve and is allowed to pass into the heating system at a pressure of from two to five pounds only. So that steam heating may to-day be classified as low pressure and vacuum. Low pressure steam is designated by the system of piping used for its conveyance. To-day we have the overhead or Mills system, the two-pipe system, the one-pipe system, the single valve system. This last system has several subdivisions, such as the continuous circuit, the wet and dry return, etc. We will consider simply the single valve or pipe system.

The overhead or Mills system was patented by Mr. Mills of Boston, but in an address by him to the master steam fitters, at their convention in New York in 1890, was released to the use of the public. It consisted of a main riser to the top of the building, laterals above the highest radiators distributing the steam to the radiator risers with corresponding branches either on basement ceiling or below the basement floor, branches for the radiators being taken out from the riser below the floor line at the radiator. This system is very useful in large buildings or buildings having very little height in basement for suitable pitch of the main pipes. The two-pipe system is one that has been adopted for many years, though not now in general use. It consisted of a separate main at basement ceiling with corresponding return at or below basement floor, each radiator equipped with two valves, one for supply and one for return, the supply coming from main at basement ceiling and the return entering the main return at or below the basement floor. Into this return, also, at frequent intervals, is connected a branch from the main steam pipe, which acts as a bleeder or drip for conducting the water from the steam main back to the boiler. In this system the main steam and main return pipes, also the risers to and from the radiators may be of smaller size than are used in the single pipe or single valve system. The double pipe system has one advantage over the last mentioned, as by its use the valves may be partially opened without causing the hammering noise noticeable in the others, unless valves are either entirely closed or opened full. Its expense and the considerable cutting necessary for its installation are against it, though it must still be used where indirect radiation is wanted. The one-pipe system is nearly if not quite obsolete. It consisted of one pipe run from top of boiler to the radiator, the boiler being the low point, so that the steam and water of condensation traveled in opposite directions in the same pipe, which of necessity was of large diameter comparatively. This system was used very extensively in connection with the old sheet iron radiator.

The single valve system is the one most in use at the present time. Having steadily gained favor since about 1880, it is now almost universally adopted. In con-

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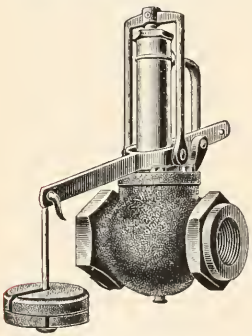

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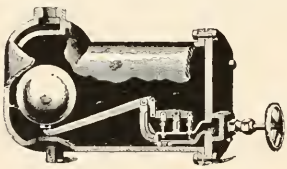

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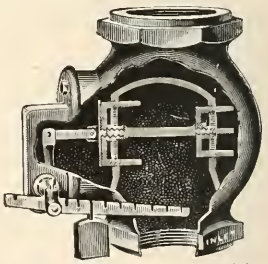

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struction it is the reverse of the single pipe system (though often misnamed the single pipe system). The high point in the main pipe is at the boiler. The main pipe may be what is known as a continuous circuit, in which case it starts high at boiler, gradually falling as it passes around the basement back to the boiler, where it abruptly drops, entering the boiler at the bottom. The water and steam in the main travels in the same direction. The laterals or branches to the radiators are taken from the top of the main and the pitch is from the radiator to the main, the water and the steam, as in the single pipe system, thus traveling in reverse directions only in the branches to the radiators. The philosophy of the single valve system lies in the fact that the transverse area of its one pipe and one valve equal nearly the transverse area of the two pipes and two valves of the two pipe system. As before stated, it is very necessary that the valves on the radiators of this system should be operated intelligently, as a valve opened partially, while permitting the steam to enter, will not permit the water (the result of the condensation of the steam) to return to the boiler. The least that can happen under these conditions is a very considerable noise in the radiator when the valve is opened until the water leaves the radiator. (It is the opinion of the writer that more than one-half the damage of cracked boiler sections can be laid to faulty manipulation of the radiator valve.)

Air valves upon radiators are important and preferably should be automatic, though whether automatic or not is a matter for the consideration of the user. The fact that the air must be expelled before the steam can enter the radiator to be condensed and yield up its heat necessitates their use. If automatic they should be non-adjustable and tinkering proof. A valve worked by air expansion is ideal for this purpose.

The thorough cleaning of the steam heating apparatus before permanent air valves are placed cannot be too greatly emphasized. Oil and sand cause more faulty working apparatus than any other cause, in apparatus that is otherwise well constructed. As a matter of fact apparatus on the verge of condemnation for general inefficiency has, in the experience of the writer, been converted into a first-class apparatus simply by a thorough cleaning and the use of chemicals to precipitate the oil, so as to facilitate its removal. To account for the presence of oil in an apparatus it is only necessary to call attention to the fact that beside the oil used in construction, all the cores over which the iron in the radiator sections, the boiler castings, and even the fittings is poured, are composed of oil and sand, part of which adhere to the inside of the castings. The steam condensing on these surfaces eventually carries this oil back to the boiler, where it lies like a blanket on top of the water. It may be removed by frequent blowing out of the boiler or a few cents' worth of chemical put into the boiler and circulated by steaming a few days, will permit of its being thoroughly cleansed by blowing it off once. This blanket of oil prevents the steam from passing through and the pressure frequently forces the water from the boiler up through the return pipes, and aside from the annoyance may easily become a dangerous condition. Why a condition so common has received so little attention is beyond finding out, and as it occurs in all steam heating apparatus this cleaning should be written in all specifications and insisted upon.

As to the size of mains, Professor Carpenter says: "The area of the main pipe must in every case be equivalent in carrying capacity to that of all the branches taken off; it consequently may be reduced as the distance from the boiler becomes greater or as more branches are supplied. It will in general be found, except when large pipes are used, less expensive to run the main full size rather than to use reducing fittings."

Find the area by multiplying the amount of radiating surface. If 1,400 feet or less, by .009; if 1,600 feet or more, by .008, and then use pipe with area nearest to that so found; thus radiating surface pipe will supply:

Diameter of Pipe.	Area in Inches.	——Radiation.—— Direct.	Indirect.
1¼ x 1	1.49	150	85
1½ x 1¼	2.03	225	140
2 x 1¼	3.35	350	200
2½ x 1½	4.78	500	300
3 x 2	7.38	800	500
3½ x 2	9.83	1100	700
4 x 2½	12.73	1500	1000
4½ x 2½	15.93	1800	1200
5 x 3	19.99	2400	1600
6 x 3½	28.88	3600	2200
7 x 4	38.73	5000	3000
8 x 4½	50.03	6500	4000
9 x 5	63.63	8000	5400
10 x 6	78.83	10000	7000

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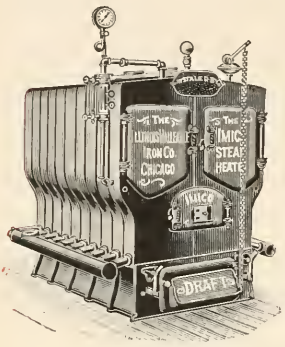

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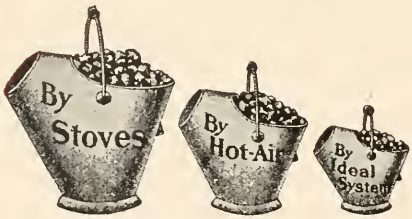

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VACUUM HEATING.

Vacuum heating is properly divided into two classes, the mechanical system, which utilizes the waste product of the power plant, i. e., the exhaust steam, and the mercury or seal system, which is adapted to the low pressure heating plant. With the mechanical system are associated such names as Napoleon Williams and W. P. Skiffington of New York, Paul of Boston, Webster of Camden and Osborn and Van Auken of Chicago. The use of the mechanical system dates back to the early seventies, though little attention was given it before Napoleon Williams demonstrated its utility. Marked progress in this method of heating waited the patents of Skiffington and the formation of the Paul Company, a corporation embracing among its members many prominent concerns engaged in the heating business. The patents of E. Osborn, application for which antedated those of Skiffington, lay dormant and were not issued from the patent office until after those of Skiffington. The Webster people in the meantime acquired the patents of Williams. Upon the issuing of the Osborn patents they were exploited by Van Auken, afterward incorporated into the Consolidated Engineering Company. This last mentioned system, in addition to having many of the features of the other systems, embraces a complete system of temperature regulation. The principle of the mechanical vacuum system is to remove the air from the heating apparatus by means of a pump and ejector or similar device. As all resistance is removed exhaust steam circulates as positively as would steam under pressure. In case there is not sufficient exhaust steam for the purpose of heating, the deficiency is made up by permitting live steam to enter the system through a pressure-reducing valve, which is a part of the apparatus. Pumping the exhaust steam from the cylinder of the engine removes all liability of back pressure. This, together with the fact that exhaust steam was formerly practically a waste product, leaves no doubt that the economical operation of power plants demands a vacuum apparatus. It has truthfully been remarked that a large building using power could be operated at less fuel expense in the winter when the heating apparatus is in use, than it could be in the summer when the heat is turned off. This is due to the fact that the engine is relieved entirely of back pressure. Where there is no steam power plant from which exhaust steam may be taken, the low pressure vacuum system is best adapted, it being evident that the expense of the power necessary to operate the mechanical exhauster of whatever nature would equal, if it did not exceed, any saving that could be effected by the use of vacuum apparatus. This fact is generally recognized by manufacturers of mechanical vacuum heating apparatus.

Low pressure vacuum heating apparatus, where a gauge was used to indicate results obtained, was first called to the attention of the writer by Mr. Haskins, an attorney-at-law residing in Cleveland, O., though most all users of low pressure steam heating having compression air valves have noted from time to time that after a radiator was heated and the air valve closed that the radiator retained the heat for a considerable time after pressure at the boiler had subsided. Many attempts were made to perfect an automatic air valve to accomplish this very much desired result, but with only partially successful results. Many patents were obtained, one of which, issued to D. F. Morgan of Chicago, about 1897-8, was quite successful. Some of these valves are still on the market. The fact remains, however, that a valve for this is, by the nature of the work it is expected to accomplish, subject to constant and rigid wear, with the result that it rapidly deteriorates, and after a short time parts of it must be renewed. This fault, together with the fact that air expelled from a heating apparatus into apartments habitated by human beings is very undesirable from a sanitary view point, has led to the revival of a very old method, that of running air pipes from the radiators into the basement, connecting them together and immersing them in a mercury seal. (Note in the early history of steam heating no apparatus was considered complete unless the air was conducted through pipes into the basement or boiler room, and this practice is still in vogue in the eastern cities.)

The first patent for a system of this kind was issued to James A. Trane of La Crosse, Wis., in 1901, and covered the use of a mercury seal in combination with an automatic air valve on the radiator. A little later in the following year a patent was issued to D. F. Morgan of Chicago for a somewhat similar system, but omitting the use of an automatic air valve. Quite a number of patents have lately issued covering all manner of devices to effect the same purpose. It is a safe proposition, therefore, to assume that members of the heating trade are alive to the possibilities of low pressure vacuum heating.

Vacuum is obtained in this system by first raising pressure to expel the air from the apparatus, the purpose of the seal being to prevent its return. By this means the boiling point of water is lowered from 212 degrees to about 100 degrees Fahr., which must be admitted to be a very desirable increase to the range of temperatures at which a steam plant may be operated, especially serviceable in the milder months of early fall and late spring. Prof. R. C. Carpenter states that his experiments have

A. W. WILLS. J. P. SMITH.

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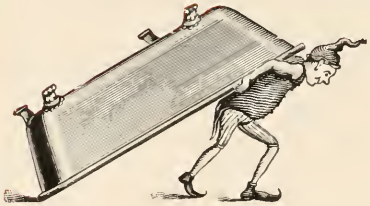

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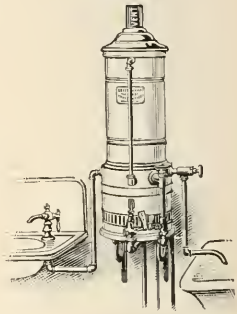

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demonstrated to his entire satisfaction that more heat units may be extracted from a pound of coal by the use of steam at or below 212 degrees Fahr. than at any degree above that point. Actual comparative tests using the same heating plant with and without vacuum attachments have shown a fuel economy of from 25 to 50 per cent, an item worthy of consideration in the operation of even the smallest heating plant. The manner of piping also precludes the possibility of damage to floors or ceilings by leakage, an advantage not to be overlooked.

The reader must not overlook the fact that above description refers to a tight plant. In ordinary practice a plant that will draw from 15 to 28″ of vacuum is easily within the possibilities. The writer having seen a complete apparatus heated when temperature in boiler registered 102 degrees Fahrenheit and has shown a number of experienced engineers that a plant found practically without circulation and cold at 120 degrees Fahrenheit could be circulated and heated throughout at 140 degrees Fahrenheit.

The bugbear of a tight plant has no foundation in fact, as any plant that shows fairly steam tight will draw a vacuum of from 15 to 28″, at which point a fuel saving of more than 25 per cent would result.

A little time spent in investigation will convince the most skeptical that the above claim is perfectly reasonable. The further fact that the heat may be controlled, and also that all danger of damage by leakage, as well as the fact that foul air from the radiators is emitted in the basement instead of into the living rooms is worthy most careful consideration. The writer is convinced that vacuum steam heating is an ideal system and is the heating of the future.

SIZES FOR CHIMNEYS.

A very essential adjunct to the working of a plant is the chimney flue, and the form of the flue has much to do with its effectiveness; thus as gases ascend in a spiral motion a round flue is the best, and a square one is better than one of rectangular shape. If of brick it should be evenly plastered. The flue should extend below the smoke pipe connection only a short distance to permit the removal of soot, if continued far below it will form an air pocket and cause down currents.

Square Feet of Direct Steam Radiation.	Horse Power.	Size of Chimney.	Square Feet of Direct Water Radiation.
250	2.5	8 x 8	400
500	5.0	8 x 12	850
800	8.0	12 x 12	1350
1400	14.0	12 x 16	2400
2200	22.0	16 x 16	3700
3500	35.0	16 x 20	5900
5500	55.0	20 x 20	9300
8000	80.0	20 x 20	13000

The ventilation of rooms is a very important factor. A certain amount of space is necessary to provide change of air, the circulation of which is of more importance than is generally attached to it, in this respect the indirect system of heating is advocated.

In theaters, churches, etc., provision should be made to admit from 400 to 1,500 cubic feet of air per hour for each person. In school rooms children should be provided with 600 cubic feet, and grown persons 1,200 cubic feet of air per hour. The Massachusetts law requires 30 cubic feet of fresh air per minute for each pupil, or 1,800 cubic feet per hour. This requirement represents the most advanced American practice. From 2,000 to 3,000 cubic feet of air per hour per occupant is required in hospitals and workshops. Each cubic foot of gas burned for illumination will consume from 8 to 12 cubic feet of air per hour.

The number of respirations men take on an average is 20 per minute, the volume of the air inhaled at each inspiration is equal to 40 cubic inches. The atmosphere of a lighted room containing several persons is vitiated to such an extent as to require a supply of fresh air equal to 4 cubic feet per minute for each.

Main supply pipes should run from top of boiler with a rising inclination of about ¼ inch to 10 ft.

A cubic inch of water at 212° becomes very nearly a cubic foot of steam at the same temperature, expanding as it does into 1,696 times its volume.

Radiation for steam weighs about 7 lbs. per sq. ft.; for hot water, about 7½ lbs.

The circulation of the air is of more importance than is generally attached to it, and the indirect system by means of which fresh heated air is introduced is to be advocated. Fire places are of great use for purposes of ventilation.

The use of heat regulation has grown so common that it has necessitated the manufacture of many different forms of thermostats to meet the requirements of the heating

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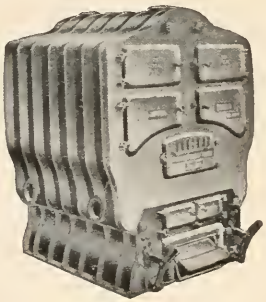

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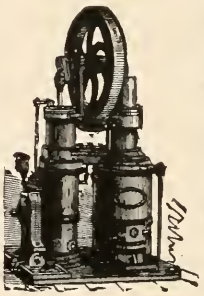

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plans, and also of many designs of covers for thermostats to meet the tastes of various users. There are many artistic designs, plain and ornamental. Architects should specify the kind of thermostat they desire to cover.

FORMULA FOR CALCULATING RADIATION.

The following is successfully used by a prominent member of the C. A. B. A.:

First ascertain the cubical contents, glass surface (which includes the surface of all exterior doors and windows), take into account whether N., S., E. or W.

Let "I" be the inside temperature desired, say 70° Fahrenheit, "E" the coldest exterior temperature, "V" volume of room in cubic feet, "W" exterior wall surface of room in square feet, "G" exterior windows and doors in square feet, "R" standard amount of surface radiation in square feet, "F" factor depending upon method of heating or particular story heated. When hot water overhead system is used: 4 story building, adopt 1.3 for first story, 1.2 for second, .90 for third and .60 for fourth. In 3 story buildings, 1.25 for first, 1 for second and .75 for third. For 2 story, 1.2 for first and .8 for second.

When the steam heating method is used, "F" becomes a constant equal to .8. "J" factor depending upon exposure equal to 1.4 for N., W. and N. W. exposures, equal to 1.2 for N. E. and S. W. exposures, equal to 1 for E., S. and S. E. exposures, and also for small interior courts and places well protected from north and west winds. For bath-rooms where a higher temperature is usually desired J is often made 2 instead of the usual rule. Kitchens where coal ranges are used, "J" is often made as low as .5, usually .75; but where there are no coal ranges "J" should be made 1-10 less than the factor obtained for the above.

$$\left\{\frac{V}{400}+\frac{W}{10}+\frac{G}{2}\right\}\left\{\frac{I\text{-}E}{I}\right\}.9 = R.$$ Q equals the desired square feet direct radiation surface for a room. Q=R F J. "E" is usually taken as 10° higher than the minimum recorded temperature of the locality. "I" is taken as 70°, therefore the quantity $\left\{\frac{I\text{-}E}{I}\right\}.9$ becomes a constant for any given locality, for Chicago where the minimum temperature is minus 20° the quantity is taken at 1.03.

The diameter of all supplies in inches should not vary materially from the square root of the amount of radiation to be supplied by the pipe, divided by 100. Reduced to inches, this rule is equally applicable to the supply of a single radiator or the supply of an entire system. Good judgment must go with the use of all empirical formula, especially in the use of the factor "J," which might be called the judgment factor. Location of surrounding buildings, trees, open space, etc., should be considered in the selection of a value for "J."

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HOW TO CONSTRUCT A TIN ROOF.

Roofs with less than one-third pitch are made with flat seams and should preferably be covered with the best kind of roofing tin, from sheets 14x20 inches dimension, rather than from sheets 20x28 inches, because the larger number of seams stiffen the surface and help to prevent buckles and rattling in stormy weather. For flat seam roof one-inch barbed and tinned roofing nails should be used, not over six inches apart, well under the edge. They should be well covered up and the seams should be pounded down over the edge with wooden mallet. Nails must never be exposed. The seams should be made with great care; sufficient time must be taken to properly "sweat" the solder into the seams.

Steep tin roofs should be made with standing seams and from sheets 20x28 inches. The sheets are first double seamed and soldered together into long strips that reach from eaves to ridge. The sloping seams are composed of two "upstands," interlocked and held in place by cleats. The standing seams are not soldered, but are simply locked together with the cleats folded in from 15 to 18 inches apart. Nails should be driven into the cleats only.

While it is always cheapest to use the best material, roofing plates with a lesser coating may be used for steep standing seam roofs. IC roofing plates, in which the iron body weighs 50 lbs. per 100 square feet, are more suitable than IX plates (62½ lbs. per 100 square feet), because the seams in the lighter plates will not suffer as much from contraction and expansion as the thicker plates.

For spouts, valleys and gutters heavily coated IX plate should always be used.

The amount of terne coating on the lighter sheets should in all cases be fully as heavy as on the heavier plates.

In late years the anxiety of some manufacturers to satisfy the demand of the people for cheap goods has been the cause of many inferior grades being introduced. This latter class of material may suit for some purposes outside of roofing or for roofs on temporary buildings, but for roofs that are expected to last, the "double dipped" and "extra coated" plates should be used.

The use of acid in soldering seams in a tin roof is to be carefully avoided; acid coming in contact with the bare iron on the cut edges and corners where the sheets are folded and seamed together will cause rusting. No other soldering flux but good rosin should be used. Every roof should be carefully cleaned and all rosin spots and detrimental substances should be removed as the tinner's work is being finished. Lumps of rosin left on the roof will melt in the sun, stick to the roof, cause blisters and prevent paint from adhering.

For valleys, spouts and gutters of a tin roof no other metal than terne plates should be used, because the galvanic action produced by different metals coming in contact with each other will cause disintegration under atmospheric influences.

The sheeting boards underlying the roofing tin should be put close together.

The wood should be well seasoned, dry and all knots should be culled out. It is also advisable to cover the boards with good building paper before the tin is laid on. The paper serves to exclude from the tin injurious vapors, gases, or fumes that continually rise from the rooms below.

When no paper is used the tin must in all cases be painted on the under side with good reliable oil paint before it is laid and fastened on the roof. The outside should receive two coats of paint as soon as the roof is finished.

To make tin roofs last for generations they should be repainted every three to five years with good iron oxide and linseed oil paint. The frequency of the intervals will depend largely on the climatic conditions of the country.

Reminders of quality remain long after the question of price is forgotten. Be satisfied only with with the best.

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POINTS ON VARNISH.

BY HERMAN ROSENBERG.

Drying and Hardening.—Proper light and ventilation are absolutely necessary to facilitate drying and hardening. Varnish applied in buildings that are damp and not properly heated in cold weather, will be considerably retarded in drying and hardening. Extremely hot weather will also keep varnish soft for quite a time. The best results are obtained at a temperature of 70 to 75 degrees Fahrenheit.

Turning White.—It is caused by the action of water and dampness. The more elastic the varnish, the better it will resist this action, whereas, cheap, brittle, quick-drying varnishes are very easily affected.

Brittleness.—Is an inherent defect in the varnish caused by an excess of dryer, lack of oil, or by adulterated materials having been used in its manufacture. If a varnish powders white under friction of the finger or easily scratches white, that is incontrovertible evidence of its poor quality. Brittle varnishes should not be used even for the undercoats, as they destroy the toughness and durability of the finish, despite its being protected with an elastic, durable finishing varnish. It is poor economy, in any event, to use brittle varnishes, as the cost of application, which is the main expense, is the same as if good material were employed.

Chilling.—As its name implies, is caused by exposure to cold weather. Varnish should never be used while in this condition. To remedy is to keep the chilled varnish in a warm room, until it has been restored to its normal condition. Long exposure to cold weather may also cause the varnish to become "specky" and "seedy." in which event it is necessary to keep it near a steam pipe or warm stove for some time, until the chilled particles have disappeared.

Cracking.—Cracking is caused by the under coats not having been dry when the finishing coat was applied, or when abnormally heavy coats have been used, especially for the undercoats. Brittle varnishes are liable to crack when exposed to sudden changes of temperature.

Blooming or Going Foggy.—Is caused by exposure to dampness, moisture or gases, after the varnish has become hard. The more elastic the varnish, the less liable it is to "bloom" or become "foggy."

Wrinkling, Crawling, Cramping or Sagging.—Is caused by applying the varnish too heavily or by exposure to sudden changes of temperature while in the process of drying, or if the undercoats are not dry when the finishing coat is applied.

Deadening or Sinking Away.—Caused by the undercoats not having been allowed sufficient time to dry, causing the finishing coat to become absorbed while in the course of hardening. Insufficient foundation coats will also cause the finishing to sink away.

Blistering.—Is caused by the action of heat, especially from the concentrated rays of the sun, if sap or dampness is retained in the wood, or if moisture exists in the undercoats when the finishing coat is applied.

Pitting.—Is caused by applying varnish over an oily or damp surface; also, if the varnisher is not careful to thoroughly incorporate the turpentine in reducing the varnish, or uses improper thinning material.

Knots and Sappy Woods.—The sap and knots should be "killed" by the use of grain or wood alcohol shellac for the first coat. If this is not done, the sap will work through and injure the finish.

Thinning.—When found necessary, should be done with spirits of turpentine. In order to insure proper amalgamation, neither the varnish nor the turpentine should be too cold when mixing. The warmer the varnish and turpentine, the quicker the amalgamation. After reducing the varnish, allow it to stand awhile before using. Oil, Japan or liquid dryer should never be added to varnish.

SWEATING.—Is caused by rubbing the undercoat before it is thoroughly dry.

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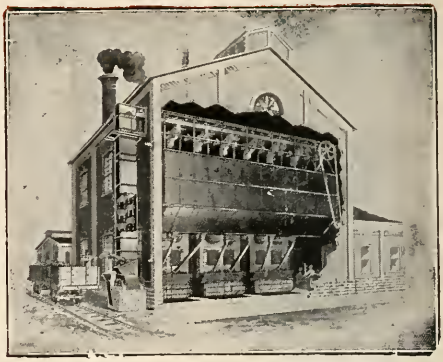

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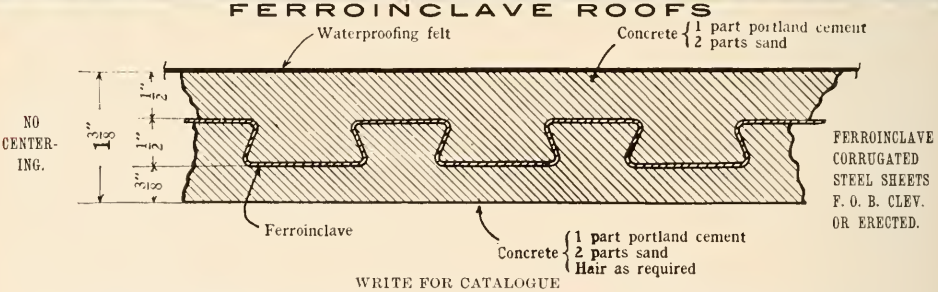

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In a general way, where the amount of material to be handled is comparatively small, and no other considerations enter, ordinary cars or trucks, platform elevators, etc., are so much cheaper than the continuous type of machinery that the latter can scarcely be considered.

The overhead trolley way, cable ways, "Telphers," etc., are a step beyond the ordinary car and platform elevator, and frequently, even where large amounts of material are handled, these will give satisfactory results, but the relative cost of handling the material in labor, etc., is usually higher with this semi-intermittent service than with the continuous systems.

The machinery for the continuous methods may be divided into two classes, belt and chain devices.

BELT DEVICES.

For handling gritty materials belts are desirable. They are silent and are preferred in office buildings for handling coal, sand, ashes, etc., for this reason.

The speed for operating depends largely on the general service, and it may run at a comparatively high speed if there are no large pieces to be carried, for some work as high as 800 to 1,000 feet per minute, but it is desirable to keep below 500 feet; and little is to be gained by reducing the speed to less than 300 feet, unless the material to be carried contains large or sharp lumps.

The amount of power consumed by a belt is less than for any chain type equipment, because the weight of the moving parts in the empty conveyor is less and is carried on rollers carefully lubricated. The material itself is always carried on these rollers and a further reduction of power attained. The amount of power depends upon the number of rollers supporting the belt, being increased by having the rollers closer together. The rollers should not be farther apart than about four feet for handling coal or material of approximate weight. For heavier material the idlers are often spaced three feet, and for handling material such as grain the spacing is much greater.

The spacing depends on local conditions and the manufacturer is able to judge the requirements.

A belt conveyor, if properly constructed and taken care of, is probably the most lasting form of conveying machinery, but its "life" depends largely upon the type of troughing idlers used where the belt is raised up on the edges. The inclination of these idlers should never be in excess of 30 degrees, and for some work considerably less. If the angle is greater the belt will split down the line where it is bent, the destruction being due to the bending of the belt. Guide idlers on the edges of the belt are objectionable, although necessary in some cases, but they should be used at the ends of a reasonably long conveyor.

Automatic lubrication should be used for the rollers. Grease cups are desirable where the material is gritty, but the cups should be controlled by a spring and should have a proper adjustment for the flow of the grease. There are several types of cup. Grease cups without the spring devices are objectionable, as they require constant screwing up.

Self-oiling rollers are equally good if dust proof. The oil should be applied near the center of the journal and should work outward toward the ends, so as to carry away particles of grit.

Whether the troughing rollers and center rollers are in line, or the center rolls just in front, is immaterial if the entire width of belt is supported.

The rollers should be heavy enough to stand the shock of large pieces passing over them on the belt, resulting in a "pound." The shafts must not be too small and should be rigidly supported, preferably at both ends. The supports should be such that the rolls can be readily "lined up," as the wear due to a roll being out of line affects the belt. The practice of some makers in mounting these roller sets on cross planks or channel irons, to be carried on side timbers, reduces this evil.

The belt itself is the most serious matter on which to decide. For handling grain any ordinary belt will do the work fairly well, but when it comes to handling ore, coal or similar material, the belt must have a protecting coat of pure rubber on the carrying side, and this must be of the best possible grade and the greatest toughness obtainable; it must also retain its "life" under all ordinary conditions of temperature, moisture, etc.

A number of belts have been in use out of doors, subjected to climatic abuse, and have given good service for three to five years. There are few on the market, however, which would do this.

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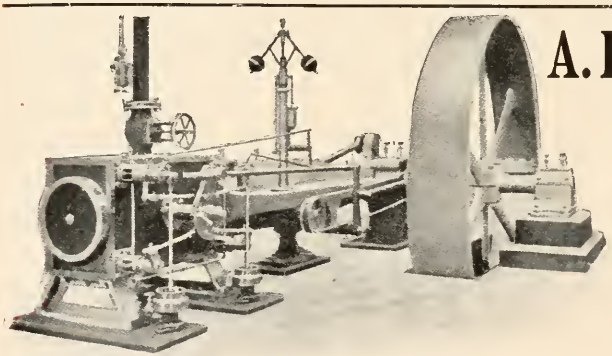

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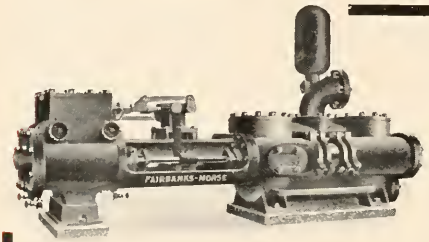

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If a cheap belt is wanted, use an ordinary stitched or woven canvas belt, as this will give better service than the cheaper "rubber" belts.

Belts are useful for handling ashes and an ordinary canvas belt makes a very lasting ash conveyor, by thoroughly wetting the ashes.

Sectional belt conveyors are made up in detachable sections 20 to 30 feet long, mounted upon castors and arranged to couple up in lengths of five or six sections, sometimes more; the various belts being driven by their own individual motor, or taking power from other units.

One maker of belt conveyors makes a line of these devices which are especially useful for warehouse work, as they can be moved around and adapted to local conditions and enable one or two men to handle an enormous amount of material. They can be operated on a horizontal plane or run inclined, or partly both, and it is not necessary to run in a straight line.

For carrying sand, earth and such materials the belt is superior to any other type of conveyor.

CHAIN DEVICES.

For the heavier types of conveying machinery chains only are available, and they offer better facilities for attaching the buckets, trays or scrapers. From the nature of construction, and the fact that they have to run on toothed sprockets, chain devices must run more slowly than devices using the belt, and the slower the machinery moves the greater the life will be, the wear increasing almost in proportion to the square of increase of speed.

Simplicity is very important. The more direct the action the better, and the action of gravitation or swinging of parts hinged to the chains should be avoided, as gravity is uncertain in its action, the movements being complicated by the acceleration of the parts.

Swinging tray elevators and pivoted bucket conveyors must be run at very slow speeds, as their action depends on maintaining the bucket or tray in an upright position by the force of gravity. It is possible to devise machinery to transfer material under almost every condition, but every device which does not receive and discharge at one point becomes more complicated. The chains used should preferably be of steel and without any cast metal in them. They should also be of as long a pitch as the machinery will allow, as the short pitch chains have more covered joints and become more elongated by wear.

The wearing surfaces should be as large as they can conveniently be made by using long pins and long seats, covered by case hardened steel bushings or phosphor bronze pads; the latter are decidedly better for most purposes, and will also wear longer on account of being thicker. Bushings of this nature are especially necessary where gritty materials are handled.

Chains assembled by riveted pins are always stronger than those put together with bolts or with loose pins with split cotters in the ends, although the facility with which the latter type of chain may be taken apart for repairs is a consideration. Large and heavy chains should be riveted up, as repairs are seldom needed in this class. The chains for coal handling devices, particularly those of the pivoted bucket type, need the bushed construction, and should have chilled wheels of large diameter mounted on bushed journals and fitted with an effective self-oiling device. Fibrous packing should not revolve with the wheel, as the inner surface becomes glazed and the oil does not pass through to the journal.

Self-oiling rollers can be obtained which will run sixty days without attention, and as the oil is always working from the center of the journal outward, all gritty material is removed and the wear on the pins greatly reduced.

The architect should consider whether an ordinary blacksmith can make repair parts for chains used, especially for isolated plants, and in large power houses time can be saved in getting a conveyor started after a break-down, if a blacksmith can make up repair parts. This cannot be done with malleable iron chains and seldom with cast steel chains. Drop forgings are also objectionable, althought they can be made up better than the others.

Ordinary round link chain is useful and repairs can be made up for this, but the rapid wear due to the small contact between the links, makes it an objectionable device for many kinds of work.

In the handling of ashes and many other materials, the erosion of the parts by acids has to be considered. Cast iron or malleable iron buckets and receptacles are superior to those made of sheet steel. Illinois coals contain a large percentage of sulphur and are ordinarily received wet, the water having stood on them long enough to become practically diluted sulphuric acid.

Devices for lubricating chains and moving parts should be direct and simple, as it is difficult to pay attention to these where the machine has to be oiled up while running. Ordinarily chain lubrication is impossible unless it is accomplished by means of self-oiling rollers, but it is desirable particularly in heavy machinery.

The indiscriminate squirting of oil on the journal usually does more harm than good, and coal conveyors are greatly injured by having ash dust carried into the working parts.

Wherever possible, journals should be lubricated by hard grease, fed from a spring grease cup. This provides a collar of grease at the end of each journal, which seals it against dust, and leaves the bearing in the best condition.

PACKAGE CONVEYORS.

Where chains are used for the connections in package conveyors, it is desirable that these should be as nearly as possible independent from the rollers which carry the loads, and that they should be so located that dust and grit cannot reach the journals. The surfaces which carry the packages should be of oak or hard maple, and, unless the materials carried are very light, the whole structure should be carried on rollers at both ends of the slats. These rollers should be of the self-oiling type, or arranged to receive oil readily without getting the black grease on the packages carried.

The belt conveying devices for handling packages described under Belt Conveyors, are a somewhat new device, but have proven desirable, and the portable type of conveyors, made up in sections, are especially useful.

COAL CONVEYORS.

In obtaining proposals for coal handling machinery, the architect should decide on several points.

It is objectionable with small plants to discharge the ashes into the conveyor which handles the coal, because the conveyor in that case has to be designed to stand the wear due to handling the ashes, and is more expensive than if designed for coal only.

When necessary to arrange for handling the ashes, it is cheaper to make one conveyor do the work. The only question is, would it not be desirable to have a duplicate device to take the ashes in case of a breakdown. Coal-handling machinery should be so designed that there will be little chance of a break-down.

To carry lump or mine run coal, a large conveyor is used on account of the lumps, and if a small capacity only is required, the cost of installing the machinery is increased over what it would be for screenings only, so that if it is possible to avoid the handling of pumps, and the capacity does not exceed twenty tons per hour, it is cheaper to install some form of V Bucket Conveyor instead of the expensive standard pivoted equipment.

Several companies are making a simple and effective cast-iron V bucket elevator which will last as long as the pivoted equipment and can be put in for less than half the cost. These can also be arranged to handle ashes, and for small plants will give good satisfaction.

The use of a crusher for lump or mine run coal will enable these small equipments to take care of the lump coal, but as the crusher must have a large size electric motor or engine to drive it, it becomes a rather expensive adjunct, and need not be installed unless a considerable amount of this coal has to be handled.

The use of high-speed elevators for handling coal straight over the top wheel, is objectionable because of the high speed at which the chains must run, and the slow speed continuous bucket type, while costing more, will be cheaper in the long run, on account of the excessive cost of repairs and in handling coal in case of a breakdown. The slow-moving, heavy continuous elevator seldom breaks down, and where it can be used instead of the pivoted bucket type by going vertically up to a sufficient height to spout by gravity into the bins, it is to be preferred, and is usually cheaper.

In machinery where lumps are handled, or where the material runs out of a large hopper under a railroad track or other location, it is desirable to use some automatic feeding device. The reciprocating loaders moving in a horizontal plane, the rotary overshot wheel type, and the cut-off gate type, operated by the conveyor, are about equally effective.

COAL UNLOADERS.

A large part of the cost of handling coal in the power plants is that of taking the coal out of the ordinary gondola cars and putting it into the conveying machinery.

Very few cars of the bottom dumping type can be obtained and the dumping devices of these few are frequently out of order, so that the coal has to be shoveled out over the side, therefore it is more satisfactory to unload the coal directly from the car to the boiler room or to the conveyor by power.

The ordinary Clam Shell Bucket Equipment will do this, but it removes only about 60% to 75% from the car without shoveling, and the old type buckets frequently injure the cars, and the railroad companies oppose their use.

In the more modern grab bucket, the closing path of the jaws is practically horizontal, and the operation by an electrically controlled trolley is simple. Any good laborer can handle such an equipment, and these devices with square-cornered grab buckets will remove about 95%, using one man in the cage and one in the car.

The same device will transfer the coal directly to the bunkers over the boilers. It is well to provide ample space above the bunkers so that economical devices can be used.

SCREW CONVEYORS.

The spiral or screw conveyor is a very simple device, and can be used for any material which does not stick to the screw and which is not in any sense abrasive, but the screw breaks the material carried, and frequently this is an objection. Where grain, cotton seed, sawdust, etc., are to be carried but a short distance, the screw is probably the cheapest and most efficient conveyor.

The continuous helicoid type has advantages over the sectional, but is objectionable in point of repair, as the whole section has to be renewed in case a small part of the "Flight" becomes injured, whereas the sectional flights can be renewed in short lengths.

Screw conveyors cannot be used for handling any material in which there are lumps of any size, the limit being about one-fourth of the diameter of conveyor.

STEEL CABLE CONVEYORS.

The use of steel cable, with discs or flights in various forms for handling all sorts of material, is comparatively old, but the conveyors of this type ordinarily give trouble on account of the stretching of the cables and the difficulty of adjusting them to the sprocket wheels at the ends. If, however, this type of conveyor is made up with a steel cable of alternately right and left twisted strands, and the coupling is made by cast-iron connections, which bolt together at a fixed distance, so that the exact length of the cable can be obtained with certainty, these devices become very satisfactory.

The coupling device and the buttons or contact blocks on the cable, which mesh with the sprocket wheels at the ends, should crimp the cable deeply and fit it accurately, otherwise they will give trouble.

The type of sprocket wheel used for the cable should also be such that a certain amount of stretch in the cable will not cause the blocks to ride on the teeth. An adjustable automatic sprocket is on the market, and makes it possible to use cable conveyors up to a length of several thousand feet.

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THE ARCHITECTURE OF THE FLAGSTAFF

By Samuel A. Treat, A. I. A.

In my paper I have discarded the use of the word "pole" and have adopted the word "staff," since I consider that the latter indicated not only a pole but a medium of support. A staff must be a pole, but a pole is not necessarily a staff. No doubt the subject of my paper will seem, in the minds of some, to be quite trivial; but it is my hope to convince such persons that there is much to be learned in the erection of the staff, whose noble purpose is to bear aloft the emblem of our liberties.

Since architecture is the science of building, it follows that the building of the flagstaff may properly come under the domain of architecture. The purpose of the staff being to bear the flag, it may be well to refer to the origin of the flag for which the staff was created.

I find that in Numbers II, in the wanderings of the Israelites in the wilderness, they were ordered to "pitch every man by his own standard with the ensign of his father's house;" and again, in Genesis, we may gather what were "the bearings that the twelve tribes bore on their banners." In the middle ages we find that the practice was still continued, and to come down to our own country and time, we learn that an act to establish the flag of the United States was passed April 4, 1817, in which was described the form of the flag which we have, for nearly a century, held in veneration. I might refer to the significations of the various shapes and colors of flags, but will not for length of time.

A visit to the roof of one of our modern skyscrapers will serve as an object lesson to those who smile at the suggestion that we need instruction in flagstaff architecture. The tapered whipstock called a "pole" is the prevailing. The segment or warped form comes next, bent from age or a poor selection of timber. The cylindrical form, devoid of all ideas of proportion, is the most prevalent, and the staff with the concave outline is an object lesson of weak form. The flagstaff supported at two points, usually from the outer walls of the building, exhibits some of the most glaring breaches of good proportion, and these supports often remind one of the boy who grasps his dinner knife half way up the blade.

The proportion to be followed in the construction of a flagstaff should be most carefully considered. A striking illustration of utter disregard of proportion in a staff supported from the outside of a building is that of the Home Insurance Building staff, where, as a result of the additional upper stories, the point of support for a six-story building was made to serve for an eight-story building. This "pole" is of sufficient length, but with the addition of the upper stories its supports should have been raised.

My attention is frequently called to the staff (I think in this case it should be designated as a "pole") on the Schiller Building tower, where the height is so inadequate that the flag, when raised, simply serves as a dust cloth to sweep the smut and dust from the dome of the tower. This is an ignominious use of our flag and an example of lack of proper study of proportion.

The care bestowed upon the proper entasis of the Grecian column is an illustration of delicacy in the use of concave forms in the erection of the column, and the same careful study is regarded in the construction of a properly proportioned staff. I have found that the ratio of the diameter to the length of a staff above its support should be about one-fifty-sixth; that the taper should commence, as in the Grecian column, one-third from the point of the support, and that the diminution should be from this point to about 45-100 of its greater diameter at the top.

Where the staff is supported at two points, the distance between these two points should be one-eighth of its whole length. The truck at the top, in form of a flat ball, should be only of sufficient size to admit a sheave big enough to carry the halyards. The iron rod (or preferably brass rod) which supports the ball or liberty cap above, should be one-twenty-fifth of the height of the staff above its

upper support and the ball surrounding the whole should coincide with the staff at its greatest diameter.

The proportions which I have named in this paper are the result of my own study and experience. Since, however, our profession is full of independent minds, it may be expected that these proportions are varied to suit the eye of the individual designer. I feel confident that no marked variation will be made in these proportions. I might be pardoned if I refer to attempts which have been made since Palladio's time to improve upon the proportions which he established, in the columns of the classic orders. In proportioning a staff, I have found it of great assistance to plan on a vertical scale of perhaps one-sixteenth and a horizontal scale of one inch to the foot. The entasis can be more carefully studied than when the drawing is made in the same vertical and horizontal scale.

The material to be used in the construction of supports on the outside of wall should be of wrought iron for obvious reasons, and careful computations have surprised me when the strain upon these supports has been ascertained as accurately as the data at hand could be determined.

It is sometimes desirable to provide a permanent metallic halyard, which by some is considered more durable than the manila halyard which is generally used. Since the cost of reefing a halyard is about three or four dollars, it is best not to endanger the flag by its contact with the metallic halyard, since the expense of repairing the flag might be much greater than the cost of employing a sailor to reef a new halyard. In the course of my experience I have erected flagstaffs of all kinds, among which were several fireproof staffs, one of which was constructed of carefully formed T-irons filled with wood, for the sake of careful outline, and then covered with copper. Another form was a wooden pole completely covered with copper. In both of these last-named forms these staffs were used as lightning conductors and metallic connection made with the earth.

In the case of a wooden staff covered with sheet metal, at least three vertical flutings should be worked in the wooden staff to admit of air circulation, the purpose being to overcome the condensation which takes place on the inner surface of the metal. Where wood staffs are covered with metallic covering, a carefully connected lightning rod should be supplied. The utmost care should be taken in making this connection, since it is quite difficult to connect a material no thicker than a sheet of copper with a cylindrical body in the form of the ordinary lightning rod. This connection should be made by an experienced man. It is needless for me to add that this lightning rod should be carried into the earth into permanent moisture.

In selecting the timber for the construction of a staff, one should be chosen which has the heart in the center of the stick, since if this is not carefully watched the staff will invariably warp. This, of course, may add to the expense, but it is an expense well incurred.

After years of observation I have reached the conclusion that we of the Twentieth Century have much to learn in the construction of the flagstaff. A diligent search through the volumes of the leading encyclopedias has convinced me that merited attention to flagstaff architecture has been entirely overlooked.

Pages, and even volumes, have been written on the subject of flags, but the importance of the standard bearer has evidently been considered unworthy of even mention. We can glean nothing from the books on the subject. Should I, in a modest way, turn the thoughts of architects of the coming century to the importance of this subject, may we not hope that future generations will turn with gratitude to the person who first called attention to what he considered was a properly proportioned and constructed flagstaff?

When freedom from her mountain height
Unfurled her banner to the air,
She tore the azure robes of night
And set the stars of glory there;
She mingled with its gorgeous dyes
The milky baldrick of the skies
And striped its pure, celestial white
With streamings from the morning light.

Now, to bear aloft this noble emblem is the purpose of the staff. It behooves us, therefore, to consider its purpose and see that this emblem is properly borne by a staff which, instead of being a mark of weakness, has all the elements of strength and durability to withstand the storms of time. It should be beautiful in proportion, strong, but yielding to the gale. It should serve as a means of protecting our lives and property by quietly conducting to the earth the deadly bolt which claims so many as its victims.

ASPHALTUM AND ITS USES.

Synopsis of paper read before the Chicago Architects' Business Association May 11, 1905, by Mr. J. S. Jackson, of the California Asphaltum Company.

The use of asphaltum, as known by the ancient and prehistoric races, is one of the "lost arts," which has been developed but little in modern times. It is first known as being found in the vicinity of the Dead Sea and floating on it. Some of its early uses were for coating the bottoms of ships and embalming the dead.

The structures of Babylon, Egypt and Corinth were built with it; the mortar in the walls of Nineveh, Jerusalem, etc., was a mixture of asphalt and sand, and the Corinthian reservoirs were lined with it. This asphalt mortar can, even now, after 4,000 years, be melted as new material. An analysis shows about 20% bitumen, of which 86% is soluble in petroleum naphtha, showing it to be petrolene, the life of asphaltum, there being no trace of oils other than those of the series of hydrocarbon oils composing asphalt.

In the construction of a highway in Peru by prehistoric races asphalt was used, and samples of this road show 23% of bitumen, of which 92% was soluble in petroleum naphtha. The asphalt was bright, melted easily and showed no signs of disintegration.

The earliest records in this country are in California; at Santa Barabara walks and roofs were constructed in 1820 and are still in good condition, and such is the case with a section of sea wall built of stone laid in asphalt mortar.

The general use of asphaltum is now a matter of careful study. It began about 35 years ago as a coating for iron pipe and has developed a demand for street paving, sidewalks, floors, pipe dip, reservoir lining, roofing, damp-proofing, paints and varnishes, insulating, wood preserving and many other matters.

Professor De Smedt, a Swiss chemist, determined the different solvents that affected the component parts of asphaltum—chloroform and bisulphide of carbon are perfect solvents for the bituminous matters in asphalts, that petroleum naphtha and ether are solvents for the series of asphalts called petrolene, and the bituminous matter soluble in alcohol he called retine; he also found that the matter soluble in bisulphide of carbon and chloroform is not soluble in petroleum naphtha or alcohol, and this substance he called asphaltine. He concluded that an asphalt containing the largest per cent of petrolene was the most desirable.

For street paving the percentage of asphaltine should not exceed 25% to 30%. In some cases a ruling is that material with excess of 25% will not be accepted.

Last year some 55,000,000 yards of asphalt paving were laid in the United States, and it is considered the standard pavement of the world. The cost is less than for wood blocks or granite and approximately on a footing with first-class brick, and the cleaning is inexpensive and effective. It can be repaired without showing that repairs have been made.

The question of slippery asphalt streets in wet weather frequently arises, and in this particular we find, on the authority of Col. W. Hayward of London, England, published in Vol. 15, Feb., 1896, A. S. C. E., that in a much-traveled street in London a horse will travel 272 miles over wood pavement without slipping, 413 miles over granite pavement without slipping, 583 miles over a sheet asphalt without slipping.

There is also a record of but 70 miles over what is termed a rock asphalt street, which is composed of bituminous limestone found in Europe, and carries from 7% to 11% of asphalt. The material is reduced by heating and is laid, etc., much as asphalt pavement is.

Many of the streets of Paris and Berlin are paved with this material; it is durable but is slippery.

Sheet asphalt streets are made with sharp sand, carbonate of lime to fill the voids and melted asphalt to thoroughly coat the sand particles and carbonate of lime. Steam rollers at least 250 pounds to the square inch should be used to thoroughly compress the material.

A good asphalt street requires knowledge of the quality of sand, the climatic conditions, etc., to determine the amount of asphalt and carbonate of lime to be added. The softness of the road in summer and hardness in winter must be considered.

In summer, with the thermometer from 75 to 80, it should work up pretty freely in its early life. It will harden with age, and as the temperature changes to a lower degree it will "iron out" and by winter will be smooth and perfect.

For basements or floors in elevated structures where the question of vibration is to be considered, there is no material that can take the place of asphaltum.

For pipe dip, in the earlier days, coal tar was used with fair success, but this was made from coal and not water gas and the material was absolutely a bench tar.

Citing a case which came under my own observation in Oakland, Cal., a tract of land called "Black Dobie Land," the land in the wet season is subject to what is termed "ground water," which rises to within five or six feet of the surface. The 36-inch main had been coated with coal tar, but this would not withstand the water which presumably was impregnated with some substance which attacked the tar coating. A recoating of pure asphalt was used and after two winters was found to be entirely unaffected by the ground water. Proper asphalt material will also fully resist the action of salt water.

As a lining for reservoirs, viaducts, etc., there is no equal to asphaltum. Cement concrete is not impervious to moisture. It is impossible to construct a cement concrete lining for the purpose without it checking and cracking. The only way to make a reservoir absolutely tight is to coat it with asphalt. Engineers are specifying that the concrete lining of reservoirs in water works systems shall be coated with at least one-eighth-inch asphaltum.

In the new water system of Cincinnati, now constructing, two reservoirs are to contain 400,000,000 gallons. They have 12-inch layer of crushed rock on the slope and bottom, followed by 6-inch best cement concrete; then a light coat of pure asphaltum, a layer of burlap and again a coat of asphaltum, the ultimate thickness of the burlap and two coats of asphaltum to be at least ¼ inch. On top is a course of brick, laid flat and grouted in cement mortar.

Philadelphia in 1892 completed a large reservoir, which was afterward treated in the same manner as above.

A feature of the lining is that it is entirely water tight and will follow any moderate settlement without cracking.

In making tests by blasting with explosives with black powder, dynamite, giant powder, etc., it has been found that cement blocks of masonry would be completely shattered, while the asphalt mortar block would be overturned and only partially rended. In the covering of magazines, batteries, etc., asphaltum has been found entirely satisfactory.

A bullet from a Kraag-Jorgensen rifle will penetrate 60 1-inch pine boards set back to back. A block of asphaltum 16 inches square allowed to stand 24 hours was set up and a bullet fired at 30 yards penetrated it but 2¼ inches.

For roofing there is no material equal to it, although there are others in their natural state, as well as various compounds now used which give fair results. For ordinary roofing the use of asphalt cannot be excelled. Owing to the methods now employed the price (at one time prohibitive) has been greatly reduced.

For mastic work, asphaltum was imported from Germany, Hungary, France, etc., and for street paving from Turkey, British West Indies, Venezuela and Cuba. In the United States it was produced by mining in the States of California and Utah. The formation of asphalt in California is caused by the seepage of asphaltic base oils through clay, sand, and fine material earth deposits, thus eliminating the volatile matter and leaving a deposit ranging from 40 to 60 per cent pure. This being mined and subjected to heat after mixing with a liquid asphalt produced in the distillation of crude asphaltic base oil, the result is refined asphaltum. At the present time the modern methods employed in distilling asphaltic base oils have made the product marketable at a lower cost than hitherto. Enough asphaltum can easily be obtained in California to supply the world.

There are found in the oil, benzine, gasoline, illuminating oil, lubricating oil, asphaltum, etc.

The cost in production is at least 45 per cent less to the consumer than five years ago, the price of it permitting its use where heretofore it was prohibitory on account of cost.

In foundation and other construction work a course of asphaltum applied hot will be impervious to moisture.

It is used as a base for paint, varnish, wood preserving and other matters, and notably insulating and electrical construction.

It is the only known preventive to the ravages of the toredo, an almost invisible insect which preys upon woodwork, piling, etc., in the waters of the Pacific and other coasts of tropical countries.

In conclusion I desire to state that it is impossible to appreciate the many uses to which asphaltum can be successfully applied.

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Six (6) Ply Cap Sheet Wool Felt, Composition and Gravel Roof.

First cover the sheathing boards with one (1) layer of dry felt and over this put four (4) thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than nine (9) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along the walls and around the openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

Six (6) Combined Flax and Wool Felt, Composition and Gravel Roof,

First cover the sheathing boards with one (1) layer of dry felt and over this put one (1) layer of flax felt and three thicknesses of wool roofing felt, weighing not less than fifteen (15) pounds (single thickness) to the square of one hundred (100) feet. This felt to be smoothly and evenly laid and well cemented together the full width of the lap, not less than eleven (11) inches between each layer, with best roofing cement, using not less than one hundred and twenty (120) pounds of roofing cement to the square of one hundred (100) feet. The entire surface then to be mopped over with roofing cement and a cap sheet of wool felt applied. All joinings along walls and around openings to be carefully made. The roof to be then covered with a heavy coating of roofing cement and screened gravel, not less than one (1) cubic yard of gravel to six hundred (600) square feet, gravel to be screened through $\frac{5}{8}$-inch mesh and free from sand and loam. All walls and openings to be flashed. If not, the rear end of the walls to be flashed not less than fifteen (15) feet from the gutter on each side.

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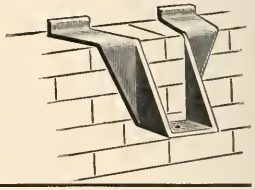

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MISCELLANEOUS AND USEFUL INFORMATION.

Useful Notes.

Roof boards weigh about three pounds per superficial foot.

Terra cotta tiling weighs from 25 to 35 pounds per square foot.

Hollow tile for five-inch partition weighs from 22 to 35 pounds per superficial foot.

Lath and plastering, two-coat work, weighs from 9 to 12 pounds per superficial foot.

The weight of a superficial foot of brickwork eight inches thick, including mortar, is from 83 to 87 pounds.

An iron roof 100 feet wide, with a rise of one-third pitch, will weigh from 10 to 15 pounds per superficial foot.

One hundred pounds per square foot distributed uniformly over a surface of a bridge is a safe working standard.

The weight per square foot of roof tiling, set in iron or between wood rafters ready for slating, is about 12 pounds.

A fireproof floor constructed of iron beams and four-inch brick arches will weigh from 65 to 75 pounds per superficial foot.

The safe and proper bearing of joist, timber and girders supporting a floor should not exceed ten tons on brick walls and fourteen tons on good stone walls.

A fireproof floor constructed of iron beams and of iron arches made of No. 18 iron, and filled in on top with concrete or slag and cement, will weigh about the same as brickwork four inches thick.

Smallest convenient size of slab for a 14-inch washbowl, 21 by 24 inches. Height of slab from floor, 2 feet 6 inches. Very small (12) inch corner washbowl: slab 1 foot 11 inches each side.

Space occupied by water closets, 2 feet 6 inches wide, 2 feet deep.

Urinals should be not less than 2 feet 2 inches between partitions; partitions 6 feet high.

Horse Stalls.—Width, 3 feet 10 inches to 4 feet, or over 5 feet in width and 9 feet long. Width should not be between 4 and 5 feet, as in such cases the horse is liable to cast himself.

Pitch of Tin, Copper or Tar and Gravel Roof.—Three-eighths of an inch to the foot and upward.

A load of mortar measures a cubic yard, requires a cubic yard of sand and nine bushels of lime, and will fill thirty hods.

A bricklayer's hod measuring one foot four inches by nine inches, equals 1,296 cubic inches in capacity, and contains twenty bricks.

A single load of sand or other materials equals a cubic yard.

One thousand bricks closely stacked occupy about fifty-six cubic feet.

One thousand old bricks cleaned and loosely stacked occupy about seventy-two cubic feet.

One hundred yards of plastering will require fourteen hundred laths, four and a half bushels of lime, four-fifths of a load of sand, nine pounds of hair and five pounds of nails, for two-coat work.

A bushel of hair weighs, when dry, about fifteen pounds.

Flashings.—By "flashings" are meant pieces of tin, zinc or copper laid over slate, and up against wall, chimneys, copings, etc.

Counter flashings are of lead or zinc, and are solid between the courses in brick, and turned down over the flashings.

In flashing against stonework, grooves should be cut to receive the counter flashing.

Water.

1 cubic foot of water equals 62.5 pounds, or 7.48 U. S. gallons.
1 cubic inch of water equals .036 pounds.
1 cubic foot of water equals 6.2355 Imp. gallons or 7.48 U. S. gallons.
1 cylindrical foot of water equals 49.1 pounds or 5.89 U. S. gallons.
1 U. S. gallon of water equals 8.34 pounds.
1 U. S. gallon of water equals 231 cubic inches.

1 pound pressure per square inch is equivalent to a head of water of 2.3093 feet; 1 pound—27.71 inches; 14.7 pounds or 1 atmosphere—33.947 feet, or 10.347 metres; 0.433 pound or 1 atmosphere—1 foot; 43.3 pounds—100 feet.

Capacity of Cisterns.

For a circular cistern, square the diameter and multiply by .7854, for the area; multiply this by 1,728 and divide by 231, for number of gallons of one foot in depth; for a square cistern, multiply length by breadth, and proceed as above.

CIRCULAR CISTERN.	SQUARE CISTERN.
5 feet in diameter holds 4.66 bbls.	5 feet by 5 feet holds 5.92 bbls.
6 feet in diameter holds 6.71 bbls.	6 feet by 6 feet holds 8.54 bbls.
7 feet in diameter holds 9.13 bbls.	7 feet by 7 feet holds 11.63 bbls.
8 feet in diameter holds 11.93 bbls.	8 feet by 8 feet holds 15.19 bbls.
9 feet in diameter holds 15.10 bbls.	9 feet by 9 feet holds 19.39 bbls.
10 feet in diameter holds 18.65 bbls.	10 feet by 10 feet holds 23.74 bbls.

Tests for Pure Water.

Color: Fill a clean long bottle of colorless glass with the water; look through it at some black object. It should look colorless and free from suspended matter. A muddy or turbid appearance indicates soluble organic matter or solid matter in suspension. Odor: Fill the bottle half full, cork it, and leave it in a warm place for a few hours. If when uncorked it has a smell the least repulsive, it should be rejected for domestic use. Taste: If water at any time, even after heating, has a disagreeable taste, it should be rejected.

A simple semi-chemical test is known as the "Heisch test." Fill a clean pint bottle three-fourths full of the water; add a half-teaspoonful of clean granulated or crushed loaf sugar; stop the bottle with glass or a clean cork and let it stand in a light and moderately warm room for forty-eight hours. If the water becomes cloudy, or milky, it is unfit for domestic use.

Expansion of Water (Dalton).

Temperature.	Expansion.	Temperature.	Expansion.	Temperature.	Expansion.
22°	1.0009	72°	1.0018	152°	1.01934
32	1	92	1.00477	172	1.02575
*46	1	112	1.0088	192	1.03265
52	1.00021	132	1.01367	212	1.0466

*Greatest density at 39.1° Fahr.

Table showing the velocity of discharge of different sized sewers.

Diam. of pipe.	180 feet per minute, 3 feet per second.		270 feet per minute, 4½ feet per second.		360 feet per minute, 6 feet per second.		540 feet per minute, 9 feet per second.	
Inches.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.	Fall.	Gallons per minute.
3.....	1 in 69	54	1 in 30.4	81	1 in 17.2	108	1 in 7.6	162
4.....	1 in 92	96	1 in 40.8	144	1 in 23.	192	1 in 10.2	288
6.....	1 in 138	216	1 in 61.2	324	1 in 34.5	432	1 in 15.3	648
9.....	1 in 207	495	1 in 92.	742.5	1 in 51.7	990	1 in 23	1,485

Rules for Calculating Speed of Pulleys.

I.—The diameter of the driver and driven being given, to find the number of revolutions of the driven:

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions.

II.—The diameter and the revolutions of the driver being given, to find the diameter of the driven, that shall make any given number of revolutions in the same time:

Rule.—Multiply the diameter of the driver by its number of revolutions, and divide the product by the number of revolutions of the driven; the quotient will be its diameter.

III.—To ascertain the size of the driver:

Rule.—Multiply the diameter of the driven by the number of revolutions you wish to make, and divide the product by the revolutions of the driver; the quotient will be the size of the driver.

Belts.

Leather belts must be well protected against water, and even moisture.

India-rubber is the proper substance for belts exposed to the weather.

It is desirable to run the grain (hair) side of leather belts on the pulley, in order that the strongest part of the belt may be subject to the least wear.

Leather belts run with grain side to the pulley will drive thirty per cent more than if run with flesh side. The belt, as well as the pulley, adheres best when smooth, and the grain side adheres best because it is smoothest.

The transmitting power of a double belt is to that of single belt as 10 is to 7. In ordering pulleys, the kind of belt to be used should always be specified.

Belts should be kept soft and pliable. For this purpose blood-warm tallow, dried in by heat of fire or the sun, is advised. Castor-oil dressing is also good.

The motion of driving should run *with* and not *against* the laps of the belts.

If too great a distance is attempted, the weight of the belt will produce a very heavy sag, drawing so hard on the shaft as to produce great friction in the bearings, while at the same time the belt will have an unsteady, flapping motion, which will destroy both the belt and machinery.

If possible to avoid it, connected shafts should never be placed one directly over the other, as in such case the belt must be kept very tight to do the work. For this purpose belts should be carefully selected of *well-stretched* leather.

It is desirable that the angle of the belt with the floor should not exceed 45 degrees. It is also desirable to locate the shafting and machinery so that belts should run off from each shaft in opposite directions, as this arrangement will relieve the bearings from the friction that would result when the belts all pull one way on the shaft.

The diameter of the pulleys should be as large as can be admitted.

The pulley should be a little wider than the belt required for the work.

When it is not convenient to measure with the tape line the length required, apply the following rule: Add the diameter of the two pulleys together, divide the result by 2, and multiply the quotient by $3\frac{1}{4}$, then add this product to twice the distance between the centers of the shafts, and you have the length required.

The width of belt needed depends on three conditions: 1. The tension of the belt. 2. The size of the smaller pulley, and the proportion of the surface touched by the belt. 3. The speed of the belt.

The working adhesion of a belt to the pulley will be in proportion both to the number of square inches of belt contact with the surface of the pulley and also to the arc of the circumference of the pulley touched by the belt. This adhesion forms the basis of all right calculation in ascertaining the width of belt necessary to transmit a given horse-power.

The average width of a shingle is four inches. Hence, when shingles are laid four inches to the weather each shingle averages 16 square inches, and 900 are required for a square of roofing (100 square feet). If 4½ inches to the weather, 800; 5 inches, 720; 5½ inches, 655; 6 inches, 600.

Weight per Square Foot of Sheet Lead.

1/64	inch	thick	2 lbs.
3/64	"	"	2½ "
1/25	"	"	3 "
1/16	"	"	4 "
1/14	"	"	5 "
1/12	"	"	6 "
1/10	inch	thick	7 lbs.
1/8	"	"	8 "
5/32	"	"	10 "
3/16	"	"	12 "
7/32	"	"	14 "
1/4	"	"	16 "

Gauges and Their Equivalents.

No.	27,	equal to	1/64	inch.	
"	21,	"	"	1/32	"
"	18,	"	"	3/64	"
"	16,	"	"	1/16	"
"	14,	"	"	5/64	"
"	13,	"	"	3/32	"
No.	12,	equal to	7/64	inch.	
"	10,	"	"	1/8	"
"	8,	"	"	11/64	"
"	6,	"	"	3/16	"
"	5,	"	"	7/32	"
"	4,	"	"	1/4	"

Capacity of Drain Pipe.

Size of Pipe.	Gallons per Minute.							
	½-in. Fall per 100 ft.	3-in. Fall per 100 ft.	6-in. Fall per 100 ft.	9-in. Fall per 100 ft.	12-in. Fall per 100 ft.	18-in. Fall per 100 ft.	24-in Fall per 100 ft.	36-in. Fall per 100 ft.
3-inch	21	30	42	52	60	74	85	104
4 "	36	52	76	92	108	132	148	184
6 "	84	120	169	206	240	294	338	414
9 "	232	330	470	570	660	810	930	1140
12 "	470	680	960	1160	1360	1670	1920	2350
15 "	830	1180	1680	2040	2370	2920	3340	4100
18 "	1300	1850	2630	3200	3740	4600	5270	6470
20 "	1760	2450	3450	4180	4860	5980	6850	8410

Grade Per Mile.

The following table will show the grade per mile:

An inclination of

1 foot in 15 is 352 feet per mile.
1 foot in 20 is 264 feet per mile.
1 foot in 25 is 211 feet per mile.
1 foot in 30 is 176 feet per mile.
1 foot in 35 is 151 feet per mile.
1 foot in 40 is 132 feet per mile.
1 foot in 50 is 106 feet per mile.
1 foot in 100 is 53 feet per mile.
1 foot in 125 is 42 feet per mile.

To find quantity of water elevated in one minute running at 100 feet of piston speed per minute: Square the diameter of the water cylinder in inches and multiply by 4. Example: Capacity of a 5-inch cylinder is desired. The square of the diameter (5 inches) in 25, which, multiplied by 4, gives 100, the number of gallons per minute (approximately).

To find the depth of a joist, the length of bearing and the thickness being given:

Rule.—Divide the square of the length in feet by the thickness in inches, and the cube root of the quotient, multiplied by 2.2 for pine, or 2.3 for oak, will be the depth in inches.

Slating.

Slating is estimated by the "square," which is the quantity required to cover 100 square feet. The slates are usually laid so that the third laps the first three inches.

Number of Slates per Square.

Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.	Size in Inches.	Pieces per Square.
6 × 12	533	8 × 16	277	12 × 20	141
7 × 12	457	9 × 16	246	14 × 20	121
8 × 12	400	10 × 16	221	11 × 20	137
9 × 12	355	9 × 18	213	12 × 22	126
7 × 14	374	10 × 18	192	14 × 22	108
8 × 14	327	12 × 18	160	12 × 24	114
9 × 14	291	10 × 20	169	14 × 24	98
10 × 14	261	11 × 20	154	16 × 24	86

The weight of slate per cubic foot is about 174 pounds, or per square foot of various thicknesses as follows:

Thickness in inches.....	1/8	3/16	1/4	3/8	1/2
Weight in pounds.....	1.81	2.71	3 62	5.43	7.25

Handy Table.

Diameter of a circle × 3.1416 = circumference.
Radius of a circle × 6.283185 = circumference.
Square of the diameter of a circle × 0.7854 = area.
Square of the circumference of a circle × 0.07958 = area.
Half the circumference of a circle × half its diameter = area.
Circumference of a circle × 0.159155 = radius.
Square root of the area of a circle + 0.56419 = radius.
Circumference of a circle × 0.31831 = diameter.
Square root of the area of a circle × 1.12838 = diameter.
Diameter of a circle × 0.86 = side of inscribed equilateral triangle.
Diameter of a circle × 0.7071 = side of an inscribed square.
Circumference of a circle + 0.225 = side of an inscribed square.
Circumference of a circle × 0.282 = side of an equal square.
Diameter of a circle × 0.8862 = side of an equal square.
Base of a triangle × ½ the altitude = area.
Multiplying both diameters and .7854 together = area of an ellipse.
Surface of a sphere × ⅙ of its diameter = solidity.
Circumference of a sphere × its diameter = surface.
Square of the diameter of a sphere × 3.1416 = surface.
Square of the circumference of a sphere × 0.3183 = surface.
Cube of the diameter of a sphere × 0.5236 = solidity.
Cube of the radius of a sphere × 4.1888 = solidity.
Cube of the circumference of a sphere × 0.016887 = solidity.
Square root of the surface of a sphere × 0.56419 = diameter.
Square root of the surface of a sphere + 1.772454 = circumference.
Cube root of the solidity of a sphere × 1.2407 = diameter.
Cube root of the solidity of a sphere × 3.8978 = circumference.
Radius of a sphere × 1.1547 = side of inscribed cube.
Square root of (⅓ of the square of) the diameter of a sphere = side of inscribed cube.
Area of its base × ⅓ of its altitude = solidity of a cone or pyramid, whether round, square, or triangular.
Area of one of its sides × 6 = surface of a cube.
Altitude of trapezoid × ½ the sum of its parallel sides = area.

Table for Mixing Paints.

In forming the following named colors, mix as they come in order, the predominant being first; second, next; third, next, and so on:

Gray—use white lead and lampblack.
Buff—use white lead, yellow ochre and red.
Pearl—use white, black and blue.
Orange—use yellow and red.
Purple—use violet, red and white.
Gold—use white, stone ochre and red.
Olive—use yellow, blue, black and white.
Chestnut—use red, black and yellow.
Flesh—use white, yellow ochre and vermillion.
Limestone—use white, yellow ochre, black and red.
Fawn—use white, yellow and red.
Chocolate—use raw umber, red and black.
Drab—use white, raw and burnt umber; or, white, yellow ochre, red and black.
Bronze-Green—use chrome green, black and yellow; or, black and yellow; or, yellow, black and green.
Pea-Green—use white and chrome green.
Rose—Use white, maddder and lake.
Copper—use red, yellow and black.
Lemon—use white and yellow.
Snuff—use yellow and vandyke brown.

Shingle Stains

Should contain a large amount of creosote for their base, and the highest grades of English ground colors, and the proper amount of fixative oil to make the colors durable and lasting. Stains are artistic colorings, and give an effect that can be got in no other way. Stains can be applied with a brush, as paint is, after the shingles are laid, or the shingles can be dipped in the stain. The coloring effect is about the same in either case, but the dipping preserves the shingles best.

Covering capacity, based on the regulation sawed cedar shingle, 4 by 16, is as follows: One brush coat, 1 gallon to 150 square feet of surface; two brush coats, 1 gallon to 100 square feet of surface; dipping, $2\frac{1}{2}$ gallons to $2\frac{3}{4}$ gallons to 1,000 shingles; dipping, and applying one brush coat after the shingles are laid, 3 gallons to 1,000 shingles. But two-thirds the length of the shingle need be dipped. When the roof-water is to be used for drinking, it should be turned off from the cistern until two or three hard rains have washed off the superfluous stain.

Dimensions of a Barrel.—Diameter of head, 17 inches; bung, 19 inches; length, 28 inches; volume, 7,680 cubic inches.

One coat or priming will take, for 100 yards of painting, twenty pounds of lead and one and one-fourth gallons of oil. Two-coat work, forty-five pounds of lead and two and one-half gallons of oil; three-coat work, seventy pounds of lead and three and three-fourths gallons of oil.

A box 24 inches long by 16 inches wide and 28 inches deep will contain a barrel, or three bushels; 24 by 16 inches and 14 inches deep contains half a barrel; 16 inches square and $8\frac{2}{5}$ inches deep will contain one bushel; 16 by $8\frac{2}{5}$ inches and 8 inches deep will contain half a bushel; 8 by $8\frac{2}{5}$ inches and 8 inches deep will contain one peck; 8 inches square and $4\frac{1}{5}$ inches deep will contain one gallon; 7 by 4 inches and $4\frac{4}{5}$ inches deep will contain half a gallon; 4 inches square and $4\frac{1}{5}$ inches deep will contain one quart; 4 feet long, 3 feet 5 inches wide and 2 feet 8 inches deep will contain one ton of coal, or 36 cubic feet.

Hot-Water and Steam Heating—Overhead System.

In using steam for the heating of high buildings, it is necessary to use the overhead plan, unless some automatic system of expelling the air is adopted. It requires less power to force the air through the standpipe than it would through a large number of risers. The air is forced out on the descent of the steam, and less fuel and power are necessary.

The overhead hot-water system is coming into general use, as it can be put in so that the farthest radiators in a building will heat at the same time as those nearer the boiler, and the result will also be felt in rooms in the basement—the principle of the siphon causing the effect.

The pipes from the main in the attic, from which the several branches are taken, can be pitched so that heat in the several parts of a building will result as quickly as desired; either an open or closed tank can be used. The pipes exposed in attic should be covered. Opinions vary as to the sizes of pipe to be used.

RADIATION REQUIRED UNDER ORDINARY EXPOSURE.

	Width.	Length.	Height.	Ratio.	Square feet of radiation.
Parlor	15.6	16.6	10.0	50	51
Dining room	12	16.6	10.0	60	34
Hall	12	12	10.0	25	57
Chamber, front	13.6	15.6	9.6	55	36
Chamber, rear	12.6	16.6	9.6	60	32
Chamber	12.6	17	9.6	60	53
Bathroom	7	8	9.6	55	9
Chamber, attic	12.3	17	9	76	24
Chamber, rear	12.6	13.3	9	80	18

List of Sizes of Steam Mains.

To determine the size of pipes no fixed rule can be given which will apply in all cases. A rule that has generally been accepted by steam fitters as good practice, is to allow the area of a one-inch pipe (.7854 square inches) for every 100 square feet of radiating surface, including mains.

Radiation.	One-pipe work.	Two-pipe work.
40 to 50 square feet	1 inch	$\frac{3}{4}$ x $\frac{3}{4}$ inch
100 to 125 square feet	$1\frac{1}{4}$ inch	1 x $\frac{3}{4}$ inch
125 to 250 square feet	$1\frac{1}{2}$ inch	$1\frac{1}{4}$ x 1 inch
250 to 400 square feet	2 inch	$1\frac{1}{2}$ x $1\frac{1}{4}$ inch
400 to 650 square feet	$2\frac{1}{2}$ inch	2 x $1\frac{1}{2}$ inch
650 to 900 square feet	3 inch	$2\frac{1}{2}$ x 2 inch
900 to 1,250 square feet	$3\frac{1}{2}$ inch	3 x $2\frac{1}{2}$ inch
1,250 to 1,600 square feet	4 inch	$3\frac{1}{2}$ x 3 inch
1,600 to 2,050 square feet	$4\frac{1}{2}$ inch	4 x $3\frac{1}{2}$ inch
2,050 to 2,500 square feet	5 inch	$4\frac{1}{2}$ x 4 inch
2,500 to 3,600 square feet	6 inch	5 x $4\frac{1}{2}$ inch
3,600 to 5,000 square feet	7 inch	6 x 5 inch
5,000 to 6,500 square feet	8 inch	7 x 6 inch
6,500 to 8,100 square feet	9 inch	8 x 6 inch
8,100 to 10,000 square feet	10 inch	9 x 6 inch

Tin roofs should be laid with cleats.

There are two kinds of tin—"bright tin," the coating of which is all tin, that is, the tin proper; and "tern," "leaded," or "roofing" tin, the coating of which is a composition, part tin and part lead. This last will not rust any quicker, but the sulphur in soft coal smoke eats through the "leaded" coating sooner than through the "tinned."

Sizes of tin, 10 by 14 and 14 by 20, and two grades of thickness—IC light, and IX, heavy. For a steep roof (one-sixth pitch or over) the IC 14 by 20 tin ("leaded" if high up where little smoke will get to it; "bright" if low down), put on with a standing groove, and with the cross seams put together with a double lock, makes as good a roof as can be made. For flat roofs IX 10 x 14 "light" is best, laid with cleats, but the others make good roofs and any of them will last twenty-five years at least, if painted periodically.

Number of Square Feet a Box of Roofing Tin Will Cover.—For flat seam roofing, using $\frac{1}{2}$-inch locks, a box of "14 by 20" size will cover about 192 square feet, and for standing seam, using $\frac{3}{8}$-inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 168 square feet.

For flat seam roofing, using $\frac{1}{2}$-inch locks, a box of "28 by 20" size will cover about 399 square feet, and for standing seam, using $\frac{3}{8}$-inch locks and turning $1\frac{1}{4}$ and $1\frac{1}{2}$ inch edges, making 1-inch standing seams, it will lay about 365 square feet.

Every box of roofing plates (IC or IX "14 by 20" or "28 by 20" sizes) contains 112 sheets.

Strains.

Tension, as in the case of a weight suspended from one end of a rod, rope, tie-bar, etc., the other end being fixed, tending to stretch or lengthen the fibers.

Shearing strain, as in the case of tree nails, pins in bridges, etc., where equal forces are applied on opposite sides in such a manner as to tend to force one part over the adjacent one.

Compression, as in the case of a weight resting on top of a column or post, tending to compress the fibers.

Transverse or cross strain, as in the case of a load on a beam tending to bend it.

Torsion, a twisting strain, which seldom occurs in building construction, though quite frequently in machinery.

Important Points in Figuring Dimensions of a Stable.

The proper height and width of a stable door is not less than nine feet square. Width and height of vehicles is as follows:

	Height.		Length.	Width.	
	Ft.	In.	Ft.	Ft.	In.
Brougham	7	0	11	6	0
Rockaway	7	0	11	6	0
Victoria	7	6	12	6	0
Demi-coach	7	0	12	6	0
Phaeton	8	6	10	6	0
Berlin Coach	7	6	13	6	6
Landau	7	6	13	6	6
Double suspension victoria	8	0	13	7	0
Vis-a-vis	7	0	12	6	0
Body brake	9	0	11	7	0
Goddard phaeton	8	0	9	6	0
Stanhope	8	0	9	6	0
Buggy	9	0	9	6	0
Single trap	6	0	9	6	0
Mail coach	9	0	15	7	6
Omnibus	8	0	11	7	0

Metric Tables.

	Approximate. Equivalent		Accurate. Equivalent
1 inch ..... [length]..	2½	cubic centimeters	2.539
1 centimeter	0.4	inch	0.393
1 yard	1	meter	0.914
1 meter (39.37 inches).....	1	yard	1.093
1 foot	30	centimeters	30.479
1 kilometer (1,000 meters).....	⅝	mile	0.621
1 mile	1½	kilometers	1.600
1 gramme .....[weight]..	15½	grains	15.432
1 grain.....	0.064	gramme	0.064
1 kilogramme (1,000 grammes).....	2.2	pounds avoirdupois.....	2.204
1 pound avoirdupois	½	kilogramme	0.453
1 ounce avoirdupois (437½ grains).....	28⅓	grammes	28.349
1 ounce troy, or apothecary (480 grains)..	31	grammes	31.103
1 cubic centimeter .....[bulk]..	1.06	cubic inch	1.060
1 cubic inch.....	16⅓	cubic centimeters	16.386
1 liter (1,000 cubic centimeters).....	1	U. S. standard quart.....	0.946
1 United States quart.....	1	liter	1.057
1 fluid ounce.....	29½	cubic centimeters	29.570
1 hectare (10,000 square meters) [surface]	2½	acres	2.471
1 acre	0.4	hectare	0.40

In the nickel five-cent piece of our coinage is a key to the tables of linear measures and weights. The diameter of this coin is two centimeters, and its weight is five grammes. Five of them placed in a row will give the length of the decimeter, and two of them will weigh a decagram. As the kiloliter is a cubic meter, the key to the measure of length is also the key to the measure of capacity.

Size of the Billiard Room, Gas Light, Etc.

The space required for the different sized tables is as follows:

For table 6 x 12.....Room should be 16 x 22
For table 5½ x 11.....Room should be 15½ x 21
For table 5 x 10.....Room should be 15 x 20
For table 4½ x 9.....Room should be 14 x 18½
For table 4 x 8.....Room should be 13 x 17
For table 3½ x 7.....Room should be 12½ x 16

The following directions for arranging the lights over billiard tables will be found useful. The distance of the light from the floor should be about 6 feet 2 inches. For a 5½ by 11 table, cross-arms 31 inches and long arms 62 inches. For a 5 by 10 table, the cross-arms of the pendant should measure, from light to light, 28 inches and the long arm 56 inches. For a 4½ by 9 table, cross-arms 25 inches and long arms 50 inches. For a 4 by 8 table, cross-arms 22 inches and long arms 44 inches.

BOWLING ALLEY STANDARD SIZE

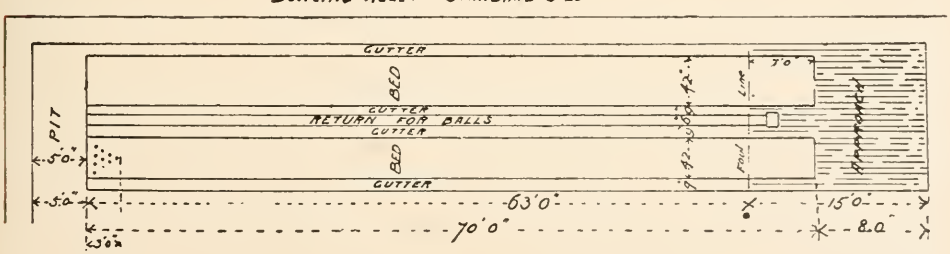
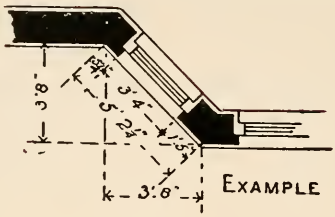


Table Showing the Length of Sides of Bays, Angle being 45 Degrees.



1	ft.	6	in.	by	1	ft.	6	in.	.....	2	ft.	$1\frac{7}{16}$	in.	2	ft.	10	in.	by	2	ft.	10	in.	.....	4	ft.	$0\frac{1}{16}$	in.
1	"	7	"	"	1	"	7	"	.....	2	"	$2\frac{7}{8}$	"	2	"	11	"	"	2	"	11	"	.....	4	"	$1\frac{1}{2}$	"
1	"	8	"	"	1	"	8	"	.....	2	"	$4\frac{1}{4}$	"	3	"	0	"	"	3	"	0	"	.....	4	"	$2\frac{15}{16}$	"
1	"	9	"	"	1	"	9	"	.....	2	"	$5\frac{11}{16}$	"	3	"	1	"	"	3	"	1	"	.....	4	"	$4\frac{5}{16}$	"
1	"	10	"	"	1	"	10	"	.....	2	"	$7\frac{1}{8}$	"	3	"	2	"	"	3	"	2	"	.....	4	"	$5\frac{3}{4}$	"
1	"	11	"	"	1	"	11	"	.....	2	"	$8\frac{1}{2}$	"	3	"	3	"	"	3	"	3	"	.....	4	"	$7\frac{1}{8}$	"
2	"	0	"	"	2	"	0	"	.....	2	"	$9\frac{1}{16}$	"	3	"	4	"	"	3	"	4	"	.....	4	"	$8\frac{9}{16}$	"
2	"	1	"	"	2	"	1	"	.....	2	"	$11\frac{3}{8}$	"	3	"	5	"	"	3	"	5	"	.....	4	"	10	"
2	"	2	"	"	2	"	2	"	.....	3	"	$0\frac{3}{4}$	"	3	"	6	"	"	3	"	6	"	.....	4	"	$11\frac{3}{8}$	"
2	"	3	"	"	2	"	3	"	.....	3	"	$2\frac{3}{16}$	"	3	"	7	"	"	3	"	7	"	.....	5	"	$1\frac{5}{16}$	"
2	"	4	"	"	2	"	4	"	.....	3	"	$3\frac{5}{8}$	"	3	"	8	"	"	3	"	8	"	.....	5	"	$2\frac{1}{4}$	"
2	"	5	"	"	2	"	5	"	.....	3	"	5	"	3	"	9	"	"	3	"	9	"	.....	5	"	$3\frac{5}{8}$	"
2	"	6	"	"	2	"	6	"	.....	3	"	$6\frac{7}{16}$	"	3	"	10	"	"	3	"	10	"	.....	5	"	$5\frac{1}{16}$	"
2	"	7	"	"	2	"	7	"	.....	3	"	$7\frac{7}{8}$	"	3	"	11	"	"	3	"	11	"	.....	5	"	$6\frac{1}{2}$	"
2	"	8	"	"	2	"	8	"	.....	3	"	$9\frac{1}{4}$	"	4	"	0	"	"	4	"	0	"	.....	5	"	$7\frac{7}{8}$	"
2	"	9	"	"	2	"	9	"	.....	3	"	$10\frac{11}{16}$	"														

Results of tests by Prof. Thomas Wilson to ascertain the amount of light passing through or obstructed by glass.

	Percentage of Light.	
	Admitted.	Obstructed.
American Crystal, ground one side	50.00	50.00
Clear Plate	87.50	12.50
American Crystal, clear, double thick	87.50	12.50
American Crystal, clear, single thick	87.50	12.50
Plate, ground one side	50.00	50.00
Plate, ground two sides	37.50	62.50
American Crystal, ground two sides	37 50	62.50
Hammered ¼ inch thick	87.50	12.50
Ribbed ¼ inch thick	75.00	25.00

Sizes of Piano.

7⅓ Octaves.

	Height.	Length.	Width.
Upright	about 4 ft. 3 in.	5 ft. 4 in.	2 ft. 3 in.
Small or Baby Grand	about 3 ft. 2 in.	6 ft. 0 in.	4 ft. 10 in.
Parlor Grand	about 3 ft. 2 in.	7 ft. 6 in.	5 ft. 0 in.

Transmission of Heat by Various Substances.

Window glass being	1,000
Oak or Walnut	66
White Pine	80
Pitch "	100
Lath and Plaster	75 to 100
Brick (rough)	200 to 250
" Whitewashed	200
Granite or Slate	250
Sheet Iron	1030 to 1110

Table Showing Amount of Glass Surface which may be Heated by 1 Square Foot of Radiating Surface in Good Buildings.

	Hot Water.			Steam.	
Temperature of radiating surface (radiators) Fahr	160°	180°	200°	227° 5 Lbs.	240° 10 Lbs.
	Square Feet of Glass to 1 Square Foot Radiator Surface.				
Temperature above surrounding air 90°	1.9	2.3	2.8	3.3	3.8
" " " " 80°	2.3	2.9	3.5	4.0	4.6
" " " " 70°	3.0	3.6	4.2	5.0	5.7
" " " " 60°	4.0	4.6	5.25	6.0	7.0
" " " " 50°	5.0	6.0	6.8	8.0	9.0
" " " " 40°	6.9	8.0	8.2	10.0	11.5

Proportion of Parts of Steam Heating Boilers.

From Prof. R. C. Carpenter.

Radiating surface=square feet	250	500	750	1000	1500	2000	3000	4000	5000	7500	10000
Nominal horse-power	2.5	5.0	7.5	10.0	15.0	20.0	30.0	40.0	50.0	75.0	100.0
Ratio radiating to heating surface	4.5	5.1	5.4	5.6	6.0	6.2	6.7	6.9	7.0 9.0*	7.0 9.0*	7.0 9.0*
Probable evaporation per lb. coal	5.5	5.7	6.0	6.5	7.0	7.5	8.0	8 5	9.0	9.5	10.0
Pounds of steam per sq. ft. grate (A)	55.0	57.0	60.0	65.0	70.0	75.0	80.0	85.0	90.0	95.0	100.0
Pounds of steam per sq. ft. grate (B)	44.0	46.0	48.0	52.0	56.0	60.0	64.0	68.0	72.0	76.0	80.0
Ratio radiating to grate surface (A)	165.0	171.0	180.0	195.0	210.0	225 0	240.0	255.0	270.0	285.0	300.0
Ratio radiating to grate surface (B)	132.0	138.0	144.0	156.0	168.0	180.0	192.0	204 0	216.0	228.0	240.0
Ratio heating to grate surface (A)	36.5	33.2	33.2	34.8	35.0	36 2	36.5	37.0	38.5	40.5 31.5*	42.5 33.3*
Ratio heating to grate surface (B)	28.5	27.0	26.7	27.7	28.0	29.0	29.3	29.6	30.8	32.2 25.2*	34.5 26.5*
Heating surface, square feet	55.0	98.0	138.0	178.0	250.0	322.0	447.0	580.0	710.0	1071 833*	1430 1111*
Grate surface, square feet (A)	1.52	2.92	4.15	5.68	7.15	8.9	12.4	15.7	18.5	26.5	33.3
Grate surface, square feet (B)	1.88	3.88	5.4	6.37	8.92	11.2	15.5	19.5	23.2	32.5	41.5
Diameter of safety valve, inches	1.5	2.25	2.50	2.75	3.0	3.25	3.5	4.2	4.0	2 of 3	2 of 4
Diameter of smoke flues, inches	7.0	10.0	11.2	12.0	15.0	17.0	19.0	23.0	25.0	28	3A
Square inches in above flues	38.5	78.5	95.0	113.0	176.7	227.0	283.5	415.5	490.9	615.7	907.9

*Water tube boilers.

A When rate of coal consumption is 10 pounds per hour each square foot grate surface.

B When rate of coal consumption is 8 pounds per hour each square foot grate surface.

Solders.

	Copper.	Tin.	Lead.	Zinc.	Silver.	Bismuth	Gold.	Cadmium.	Antimony.
Tin		25	75						
Tin		58	16			16			10
Tin, coarse, melts at 500°		33	67						
Tin, ordinary, melts at 360°		67	33						
Spelter, soft	50			50					
Spelter, hard	65			35					
Lead		33	67						
Steel	13			5	82				
Brass or Copper	50			50					
Fine Brass	47			47	6				
Pewterer's, or soft		33	45			22			
Pewterer's, or soft		50	25			25			
Plumber's pot metal		33	67						
" " coarse		25	75						
" " fine		67	33						
" " fusible		50	50						
" " very fusible		25	25			50			
Gold	4			7			89		
Gold, hard	66			34					
Gold, soft		66	34						
Silver, hard	20				80				
Silver, soft	12				67			21	
Pewter		40	20			40			
Iron	66			33					1
Copper	53	47							

Length in Feet of Joists, Scantling and Timber.

Size in Inches	12	14	16	18	20	22	24	26	28	30	42	44	45
2 x 4	8	9	11	12	13	15	16	17	19	20	28	29	30
2 x 6	12	14	16	18	20	22	24	26	28	30	42	44	45
2 x 8	16	19	21	24	27	29	32	35	37	40	53	58	60
2 x 10	20	23	27	30	33	37	40	43	47	50	70	74	75
2 x 12	24	28	32	36	40	44	48	52	56	60	84	88	90
3 x 4	12	14	16	18	20	22	24	26	28	30	42	44	45
3 x 6	18	21	24	27	30	33	36	39	42	45	63	66	68
3 x 8	24	28	32	36	40	44	48	52	56	60	84	88	90
3 x 10	30	35	40	45	50	55	60	65	70	75	105	110	113
3 x 12	36	42	48	54	60	66	72	78	84	90	126	132	135
4 x 4	16	19	21	24	27	29	32	35	37	40	56	58	60
4 x 6	24	28	32	36	40	44	48	52	56	60	84	88	90
4 x 8	32	37	43	48	53	59	64	69	75	80	112	118	120
4 x 10	40	47	53	60	67	73	80	87	93	100	140	146	150
4 x 12	48	56	64	72	80	88	96	104	112	120	168	176	180
6 x 6	36	42	48	54	60	66	72	78	84	90	126	132	135
6 x 8	48	56	64	72	80	88	96	104	112	120	168	176	180
6 x 10	60	70	80	90	100	110	120	130	140	150	210	220	225
6 x 12	72	84	96	108	120	132	144	156	168	180	250	265	270
8 x 8	64	75	85	96	107	117	128	139	149	160	224	234	240
8 x 10	80	93	107	120	133	147	160	173	187	200	280	294	300
8 x 12	96	112	128	144	160	176	192	208	224	240	336	352	360
10 x 10	100	117	133	150	167	183	200	217	233	250	350	366	375
10 x 12	120	140	160	180	200	220	240	260	280	300	420	440	450
12 x 12	144	168	192	216	240	264	288	312	336	360	504	528	540
12 x 14	168	196	224	252	280	308	336	364	392	420	588	616	630
14 x 14	196	220	261	294	327	359	392	425	457	480	686	718	735

Table Showing the Pressure of Water at Different Elevations.

Feet Head	Equals Pressure per Square Inch.	Feet Head	Equals Pressure per Square Inch	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch.	Feet Head.	Equals Pressure per Square Inch	Feet Head	Equals Pressure per Square Inch
1	.43	65	28.15	130	56.31	195	84 47	260	112.62	350	151 61
5	2 16	70	30.32	135	58.48	200	86 63	265	114 79	360	155.94
10	4 33	75	32 48	140	60.64	205	88 80	270	116.96	370	160.27
15	6.49	80	34 65	145	62 81	210	90 96	275	119.12	380	164.61
20	8.66	85	36.82	150	64.97	215	93 14	280	121.29	390	168 94
25	10.82	90	38 98	155	67.14	220	95.30	285	123.45	400	173 27
30	12 99	95	41.15	160	69.31	225	97.49	290	125 62	500	216 58
35	15.16	100	43 31	165	71.47	230	99.63	295	127.78	600	259.90
40	17.32	105	45.48	170	73.64	235	101.79	300	129.95	700	303 22
45	19 49	110	47 64	175	75.80	240	103.96	310	134.28	800	346.54
50	21.65	115	49.81	180	77.97	245	106 13	320	138 62	900	389 86
55	23.82	120	51.98	185	80.14	250	108 29	330	142 95	1.000	433.18
60	25 99	125	54.15	190	82.30	255	110 46	340	147 28	. . .	. . .

Wrought-iron Welded Pipe.

DIMENSIONS, WEIGHTS, ETC., OF STANDARD SIZES FOR STEAM, GAS, WATER, OIL, ETC.

Inside Diameter	Outside Diameter	External Circumference, A	Length of Pipe per Sq Foot of Outside Surface.	Internal Area	External Area.	Length of Pipe containing one Cubic Foot.	Weight per Foot of Length	No. of Threads per Inch of Screw.	Contents in *Gallons per Foot.	Weight of Water per Foot of Length.
In.	In	In.	Ft.	In.	In	Ft	Lbs.			Lbs.
⅛	40	1 272	9.44	012	129	2,500	.24	27	.0006	005
¼	.54	1.636	7.075	049	229	1,385.	.42	18	.0026	021
⅜	67	2.121	5.657	110	358	751.5	.56	14	0057	.047
½	84	2 652	4.502	196	554	472.4	84	14	0102	085
¾	1 05	3 299	3 637	441	866	270.	1.12	11½	0230	.190
1	1 31	4 134	2 903	785	1.357	166.9	1 67	11½	0408	.349
1¼	1 66	5.215	2 301	1 227	2 164	96.25	2.25	11½	0638	.527
1½	1 9	5.969	2.01	1.767	2 835	70.65	2.69	11½	0918	760
2	2 37	7.461	1 611	3.141	4.330	42.36	3.66	8	1632	1.356
2½	2 87	9 032	1 328	4.908	6.491	30.11	5.77	8	2550	2.116
3	3 5	10 996	1.091	7.068	9.621	19.49	7.54	8	3673	3 049
3½	4	12.566	955	9 621	12 566	14.56	9 05	8	.4998	4 155
4	4 5	14 137	849	12.566	15.904	11.31	10.72	8	6528	5.405
4½	5.	15 708	765	15.904	19 635	9 03	12.49	8	8263	6.851
5	5.56	17 475	629	19 635	24.299	7 20	14.56	8	1.020	8.500
6	6 62	20 813	577	28 274	34.471	4 98	18 76	8	1 469	12.312
7	7.62	23 954	505	38 484	45.663	3.72	23 41	8	1.999	16.662
8	8 62	27.096	.444	50.265	58.426	2.88	28 34	8	2 611	21.750
9	9 68	30 433	394	63 617	73.715	2 26	34 67	8	3.300	27 500
10	10 75	33.772	355	78.540	90.792	1 80	40 64	8	4 081	34 000

* The Standard U. S. gallon of 231 inches.

Multiply the external circumfereuce column, A, by 12 and the result will be the square feet of surface per lineal foot

Quantity of Brickwork in Barrel Drains and Wells.

Diameter in Clear	Thickness of Brickwork	Superficial Feet of Brickwork in One Linear Yard.	Number of Bricks Required for One Linear Yard
1 foot, 0 inches	0 feet, 4½ inches	16 feet, 6 inches	115
1 " 6 "	0 " 4½ "	21 " 2 "	148
2 " 0 "	0 " 4½ "	25 " 10 "	181
2 " 0 "	0 " 9 "	33 " 0 "	462
2 " 6 "	0 " 9 "	37 " 8 "	528
2 " 6 "	1 " 1 "	43 " 2 "	906
3 " 0 "	0 " 9 "	42 " 6 "	594
3 " 0 "	1 " 1 "	47 " 10 "	1004
3 " 6 "	0 " 9 "	47 " 1 "	659
3 " 6 "	1 " 1 "	52 " 7 "	1104
4 " 0 "	0 " 9 "	51 " 10 "	725
4 " 0 "	1 " 1 "	57 " 3 "	1203
5 " 0 "	0 " 9 "	61 " 3 "	857
5 " 0 "	1 " 1 "	66 " 9 "	1402
6 " 0 "	1 " 1 "	76 " 1 "	1597
7 " 0 "	1 " 1 "	85 " 6 "	1795

TABLE OF TREADS AND RISES.

No. of treads.	6		6¼		6½		6¾		7		7⅛		7¼		7⅜		7½		7⅝		7¾		7⅞		8		8¼		8½		9		9½		10		10½		11		13		14	
	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.	Inch ft.	Rise. in.
1		6		6¼		6½		6¾		7		7⅛		7¼		7⅜		7½		7⅝		7¾		7⅞		8		8¼		8½		9		9½		10		10½		11	1	1	1	2
2	1	0	1	0½	1	1	1	1½	1	2	1	2¼	1	2½	1	2¾	1	3	1	3⅛	1	3½	1	3¾	1	4	1	4½	1	5	1	6	1	7	1	8	1	9	1	10	2	2	2	4
3	1	6	1	6¾	1	7½	1	8¼	1	9	1	9⅜	1	9¾	1	10⅛	1	10½	1	10⅞	1	11⅛	1	11⅝	2	0	2	0¾	2	1½	2	3	2	4½	2	6	2	7½	2	9	3	3	3	6
4	2	0	2	1	2	2	2	3	2	4	2	4½	2	5	2	5½	2	6	2	6½	2	7	2	7½	2	8	2	9	2	10	3	0	3	2	3	4	3	6	3	8	4	4	4	8
5	2	6	2	7⅛	2	8½	2	9¾	2	11	2	11⅝	3	0¼	3	0⅞	3	1½	3	2⅛	3	2¾	3	3⅜	3	4	3	5¼	3	6½	3	9	3	11½	4	2	4	4½	4	7	5	5	5	10
6	3	0	3	1½	3	3	3	4½	3	6	3	6¾	3	7½	3	8¼	3	9	3	9¾	3	10½	3	11¼	4	0	4	1½	4	3	4	6	4	9	5	0	5	3	5	6	6	6	7	0
7	3	6	3	7¾	3	9½	3	11¼	4	1	4	1⅞	4	2¾	4	3⅝	4	4½	4	5⅜	4	6¼	4	7⅛	4	8	4	9¾	4	11½	5	3	5	6½	5	10	6	1½	6	5	7	7	8	2
8	4	0	4	2	4	4	4	6	4	8	4	9	4	10	4	11	5	0	5	1	5	2	5	3	5	4	5	6	5	8	6	0	6	4	6	8	7	0	7	4	8	8	9	4
9	4	6	4	8¼	4	10½	5	0¾	5	3	5	4⅛	5	5¼	5	6⅜	5	7½	5	8⅝	5	9¾	5	10⅞	6	0	6	2¼	6	4½	6	9	7	1½	7	6	7	10½	8	3	9	9	10	6
10	5	0	5	2½	5	5	5	7½	5	10	5	11¼	6	0½	6	1⅞	6	3	6	4¼	6	5½	6	6¾	6	8	6	10½	7	1	7	6	7	11	8	4	8	9	9	2	10	10	11	8
11	5	6	5	8¾	5	11½	6	2¼	6	5	6	6⅜	6	7¾	6	9⅛	6	10½	6	11⅞	7	1¼	7	2⅝	7	4	7	6¾	7	9½	8	3	8	8½	9	2	9	7½	10	1	11	11	12	10
12	6	0	6	3	6	6	6	9	7	0	7	1½	7	3	7	4½	7	6	7	7½	7	9	7	10½	8	0	8	3	8	6	9	0	9	6	10	0	10	6	11	0	13	0	14	0
13	6	6	6	9¼	7	0½	7	3¾	7	7	7	8⅝	7	10¼	7	11⅞	8	1½	8	3⅛	8	4¾	8	6⅜	8	8	8	11¼	9	2½	9	9	10	3½	10	10	11	4½	11	11	14	1	15	2
14	7	0	7	3½	7	7	7	10½	8	2	8	3¾	8	5½	8	7¼	8	9	8	10¾	9	0½	9	2¼	9	4	9	7½	9	11	10	6	11	1	11	8	12	3	12	10	15	2	16	4
15	7	6	7	9¾	8	1½	8	5¼	8	9	8	10⅞	9	0¾	9	2⅝	9	4½	9	6⅜	9	8¼	9	10⅛	10	0	10	3¾	10	7½	11	3	11	10½	12	6	13	1½	13	9	16	3	17	6
16	8	0	8	4	8	8	9	0	9	4	9	6	9	8	9	10	10	0	10	2	10	4	10	6	10	8	11	0	11	4	12	0	12	8	13	4	14	0	14	8	17	4	18	8
17	8	6	8	10¼	9	2½	9	6¾	9	11	10	1⅛	10	3¼	10	5⅜	10	7½	10	9⅝	10	11¾	11	1⅞	11	4	11	8¼	12	0½	12	9	13	5½	14	2	14	10½	15	7	18	5	19	10
18	9	0	9	4½	9	9	10	1½	10	6	10	8¼	10	10½	11	0¾	11	3	11	5¼	11	7½	11	9¾	12	0	12	4½	12	9	13	6	14	3	15	0	15	9	16	6	19	6	21	0
19	9	6	9	10¾	10	3½	10	8¼	11	1	11	3⅜	11	5¾	11	8⅛	11	10½	12	0⅞	12	3¼	12	5⅝	12	8	13	0¾	13	5½	14	3	15	0½	15	10	16	7½	17	5	20	7	22	2
20	10	0	10	5	10	10	11	3	11	8	11	10½	12	1	12	3½	12	6	12	8½	12	11	13	1½	13	4	13	9	14	2	15	0	15	10	16	8	17	6	18	4	21	8	23	4
21	10	6	10	11¼	11	4½	11	9¾	12	3	12	5⅞	12	8¼	12	10⅞	13	1½	13	4⅛	13	6¾	13	9⅜	14	0	14	5¼	14	10½	15	9	16	7½	17	6	18	4½	19	3	22	9	24	6
22	11	0	11	5½	11	11	12	4½	12	10	13	0¾	13	3½	13	6¼	13	9	13	11¾	14	2½	14	5¼	14	8	15	1½	15	7	16	6	17	5	18	4	19	3	20	2	23	10	25	8
23	11	6	11	11¾	12	5½	12	11¼	13	5	13	7⅜	13	10¾	14	1⅝	14	4½	14	7⅜	14	10¼	15	1⅛	15	4	15	9¾	16	3½	17	3	18	2½	19	2	20	1½	21	1	24	11	26	10
24	12	0	12	6	13	0	13	6	14	0	14	3	14	6	14	9	15	0	15	3	15	6	15	9	16	0	16	6	17	0	18	0	19	0	20	0	21	0	22	0	26	0	28	0
25	12	6	13	0¼	13	6½	14	0¾	14	7	14	10⅛	15	1¼	15	4⅜	15	7½	15	10⅝	16	1¾	16	4⅞	16	8	17	2¼	17	8½	18	9	19	9½	20	10	21	10½	22	11	27	1	29	2
26	13	0	13	6½	14	1	14	7½	15	2	15	5¼	15	8½	15	11¾	16	3	16	6¼	16	9½	17	0¾	17	4	17	10½	18	5	19	6	20	7	21	8	22	9	23	10	28	2	30	4
27	13	6	14	0¾	14	7½	15	2¼	15	9	16	0⅜	16	3¾	16	7⅛	16	10½	17	1⅞	17	5¼	17	8⅝	18	0	18	6¾	19	1½	20	3	21	4½	22	6	23	7½	24	9	29	3	31	6
28	14	0	14	7	15	2	15	9	16	4	16	7½	16	11	17	2½	17	6	17	9½	18	1	18	4½	18	8	19	3	19	10	21	0	22	2	23	4	24	6	25	8	30	4	32	8
29	14	6	15	1¼	15	8½	16	3¾	16	11	17	2⅝	17	6¼	17	9⅞	18	1½	18	5⅛	18	8¾	19	0⅜	19	4	19	11¼	20	6½	21	9	22	11½	24	2	25	4½	26	7	31	5	33	10
30	15	0	15	7½	16	3	16	10½	17	6	17	9¾	18	1½	18	5¼	18	9	19	0¾	19	4½	19	8¼	20	0	20	7½	21	3	22	6	23	9	25	0	26	3	27	6	32	6	35	0

Some of the Physical Properties of Metals—Compiled from the Best Authorities.

Common Name.	Chemical Name.	Initial.	Atomic Weight.	Specific Gravity.	Weight Cubic Inch.	Weight Cubic foot.	Melting Point F.	Specific Heat.	Conductivity of Heat.	Conductivity of Electricity.	Expansion 32 to 212° F.	Hardness, the Diamond.=3010.	Density.	Ductility, Gold being 1.	Malleability, Gold being 1.	Approximate price per lb. avoirdupois.
Hydrogen	Same.....	H.	1.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aluminum	Same.....	Al.	27.3	2.55	.0924	159.005	1160	.214	31.33	.....	.....	821	.....	.....	.....	$ 16.30
Antimony.....	Stibium	Sb.	122.0	6.71	.242	418.402	842	.0508	4.03	4.6	.....	.....	.....	.....	.....	0.36
Bismuth	Same.....	Bi.	207.5	9.823	.354	612.513	510	.0308	1.8	1.1	. 004	.....	10.035	.....	.....	1.95
Cadmium	Same.....	Cd.	111.6	8.60	.31	536.253	500	.0567	20.06	.....	.0094	760	8.217	.....	.....	3.26
Copper	Cuprum	Cu.	63.3	8.82	.318	549.971	1930	.093	74.8	94.1	.0051	1360	.....	6	3	0.22
Gold	Aurum	Au.	196.2	19.32	.697	1224.699	1915	.0324	54.8	73.0	.....	979	.....	1	1	299.72
Indium	Same.....	Ir.	196.7	22.42	.809	1392.999	4500	.0326	.....	.....	.....	984	.....	.....	.....	466.59
Iron.....	Ferrum	Fe.	55.9	7.8	.281	486.369	3000	.1138	10.1	15.5	.0035	1375	.....	4	8	0.015
Lead	Plumbum.....	Pb.	206.4	11.37	.410	708.976	625	.0314	7 9	7.6	.0084	570	10.370	9	6	0.06
Magnesium	Same.....	Mg.	23.94	1.74	.628	89.791	1200	.25	34.3	.....	.0083	726	.....	.....	.....	45.30
Manganese....	Same.	Mn.	58.8	8.0	.289	498.84	3420	.122	.....	.....	.....	1456	.....	.....	.....	108.72
Mercury.....	Hydrargyrum..	Hg.	199.8	13.58	.490	846.781	39	.0317	1.3	.....	.0182	0	.....	.....	.....	1.00
Nickel.....	Same.....	Ni.	58.6	8.80	.318	551.842	3000	.109	.....	13.1	.0038	1410	.....	5	9	5.80
Platinum	Same.....	Pt.	196.7	21.50	.777	155.887	3200	.0324	9.4	16.6	.0027	1107	.....	3	5	122.31
Potassium	Kalium	K.	39.04	.875	.0316	54.561	110	.166	.....	.....	.....	230	.....	.....	.....	22.65
Silver	Argentum	Ag.	107.66	10.53	.38	656.598	1750	.056	100.00	100.0	.0056	990	.....	2	2	18.60
Sodium.....	Natrium	Na.	23.0	.9735	.035	60.503	170	.293	36.5	.....	.....	400	.....	.....	.....	3.26
Steel	.....	.....	.....	7.854	.283	489.736	2550	.1165	11.6	12.0	.....	.....	.....	... ..	.....	0.025
Tin	Stannum	Sn.	117.8	7.293	.263	454.754	440	.055	15.4	11.4	.0069	651	7.025	8	4	0.25
Zinc	Same.....	Zn.	64.9	7.14	.258	444.215	780	.096	36.0	29 0	.0088	1077	6.480	7	7	0.10

LAW OF SPECIFIC HEAT—In order to raise the temperature of different bodies the same number of thermometric degrees very different amounts of heat are required. The atoms of the solid element possess sensibly the same specific heat.

DUCTILITY—The property of being drawn into wire or threads.

MALLEABILITY—The capacity of being extended in all directions by beating with the hammer.

Table of greatest center loads for horizontal rectangular beams of white or yellow pine, or of spruce, 1 inch broad, supported at both ends, and required not to bend more than $\frac{1}{40}$ inch per foot of clear span, or $\frac{1}{480}$ part of the entire clear span. In practice, to allow for knots, &c, take only ⅔ rds.

This table was calculated with a constant .000325, instead of .00032. The loads in this table include the weight of the clear beam itself; .625 of which (or ⅝ of which) must be deducted from the tabular loads to get the neat load, when the beam is loaded at its center. When uniformly loaded, the loads will be 1.6 times as great as those in this table; but in that case the weight of the entire clear beam must be deducted. In practice this deduction need rarely be made.

Depths in Inches.	CLEAR SPANS IN FEET. (TRAUTWINE) 3	4	5	6	7	8	9	10	12	14	16	18	20	25	30	35	40	Depth in Ins.	Wt. of 10 ft. Lgth of Beam.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		lbs.
1	8.4	4.8	3.0	2.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	2
½	28.7	16.2	10.4	7.2	5.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	½	3
2	68.4	38.4	24.4	17.1	12.4	9.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	4
½	.....	75	48	33	24	19	14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	½	5
3	.....	130	83	58	42	32	26	21	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	6
½	.....	.....	131	92	67	51	40	33	23	.....	.....	.....	.....	.....	.....	.....	.....	½	7
4	.....	.....	196	137	100	77	60	49	34	25	.....	.....	.....	.....	.....	.....	.....	4	8
½	.....	.....	.....	192	144	108	86	70	48	36	27	.....	.....	.....	.....	.....	.....	½	9
5	.....	.....	.....	267	196	150	116	96	66	49	37	29	.....	.....	.....	.....	.....	5	10
½	.....	.....	.....	.....	260	200	156	128	89	65	50	39	32	.....	.....	.....	.....	½	11
6	.....	.....	.....	.....	336	259	204	166	115	84	64	51	41	26	.....	.....	.....	6	12
½	.....	.....	.....	.....	.....	332	260	207	148	109	83	65	52	33	23	.....	.....	½	13
7	.....	.....	.....	.....	.....	412	324	263	183	134	102	81	66	42	29	21	.....	7	14
½	.....	.....	.....	.....	.....	511	403	324	225	166	126	100	82	52	36	26	.....	½	15
8	.....	.....	.....	.....	.....	.....	484	394	273	201	154	121	98	63	44	32	24	8	16
½	.....	.....	.....	.....	.....	.....	585	475	330	241	184	145	117	74	52	38	29	½	17
9	.....	.....	.....	.....	.....	.....	692	560	389	286	219	173	140	90	62	45	35	9	18
½	.....	.....	.....	.....	.....	.....	.....	662	460	336	257	202	164	104	72	52	40	½	19
10	.....	.....	.....	.....	.....	.....	.....	769	534	392	300	237	192	123	85	63	48	10	20
½	.....	.....	.....	.....	.....	.....	.....	.....	619	454	348	274	221	141	98	71	54	½	21
11	.....	.....	.....	.....	.....	.....	.....	.....	711	522	399	316	256	163	114	83	64	11	22
½	.....	.....	.....	.....	.....	.....	.....	.....	813	597	456	361	291	185	129	93	71	½	23
12	.....	.....	.....	.....	.....	.....	.....	.....	923	678	519	410	332	212	148	108	83	12	24
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	874	669	528	420	273	188	138	105	13	26
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	1075	823	651	527	337	234	172	132	14	28
15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1000	801	652	411	290	212	162	15	30
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1230	971	787	504	350	257	197	16	32
17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1175	944	604	420	309	236	17	34
18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1385	1121	717	498	365	280	18	36
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1538	984	684	502	384	20	40
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1309	910	668	512	22	44
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1701	1181	867	664	24	48
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1503	1104	845	26	52
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1876	1378	1055	28	56
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1695	1297	30	60

On this side of the dark lines, the safe loads of table ... would not bend the wooden beams as much as $\frac{1}{480}$ of their clear span.

Iron and Steel.

Average cast iron, with the same safe def will bear about 11½ as much as common yellow or white pine, or spruce: and wrought iron 19 times as much. The same proportion of the weight of the beam itself must, however, be deducted as stated above for wood. Average steel 29 times as much as pine.

TABLES OF SAFE LOADS FOR RECTANGULAR AND CYLINDRICAL COLUMNS.

Safe Loads in Tons of 2,000 Lbs. for Hollow Rectangular Cast Iron Columns.

Length in Feet.	6 x 8 INCHES.						6 x 10 INCHES.						8 x 12 INCHES.						Length in Feet.
	Thickness of Metal in Inches.																		
	¾	⅞	1	1⅛	1¼	1⅜	¾	⅞	1	1⅛	1¼	1⅜	¾	⅞	1	1⅛	1¼	1⅜	
7	73.2	83.0	92.1	100.5	108.3	115.5	85.9	97.6	108.7	119.0	128.6	137.7	98.5	112.2	125.2	137.4	149.0	159.7	7
8	68.6	77.6	86.0	93.7	100.7	107.2	80.7	91.6	101.7	111.2	120.0	128.1	92.7	105.4	117.4	128.6	139.1	148.9	8
9	64.1	72.3	80.0	87.0	93.3	99.1	75.5	85.5	94.8	103.5	111.4	118.7	86.9	98.6	109.6	119.9	129.4	138.3	9
10	59.6	67.2	74.2	80.5	86.2	91.5	70.5	79.7	88.2	96.0	103.2	109.8	81.2	92.0	102.1	111.4	120.1	128.0	10
11	55.4	62.3	68.7	74.4	79.6	84.2	65.6	74.0	81.8	88.9	95.4	101.3	75.7	85.7	94.9	103.4	111.2	118.4	11
12	51.4	57.8	63.5	68.7	73.3	77.5	61.0	68.7	75.8	82.3	88.1	93.4	70.5	79.7	88.1	95.8	102.9	109.3	12
13	47.7	53.5	58.7	63.4	67.6	71.3	56.7	63.8	70.2	76.1	81.4	86.2	65.6	74.0	81.7	88.7	95.1	100.9	13
14	44.2	49.5	54.3	58.5	62.3	66.7	52.7	59.2	65.0	70.4	75.2	79.5	61.0	68.7	75.8	82.2	88.0	93.2	14
15	41.0	45.9	50.2	54.1	57.5	60.5	48.9	54.9	60.3	65.1	69.5	73.3	56.8	63.9	70.3	76.1	81.4	86.1	15
16	38.1	42.5	46.5	50.0	53.1	55.8	45.5	51.0	55.9	60.3	64.3	67.8	52.9	59.4	65.2	70.6	75.4	79.7	16
17	35.3	39.4	43.1	46.3	49.1	51.6	42.3	47.3	51.9	55.9	59.5	62.7	49.2	55.2	60.6	65.5	69.9	73.7	17
18	32.9	36.6	40.0	49.9	45.5	47.7	39.4	44.0	48.2	51.9	55.2	58.1	45.9	51.4	56.4	60.9	64.8	68.4	18
19	30.6	34.1	37.1	39.8	42.2	44.3	36.7	41.0	44.8	48.2	51.2	53.9	42.8	47.9	52.5	56.6	60.3	63.5	19
20	28.5	31.7	34.5	37.0	39.2	41.1	34.3	38.2	41.8	44.9	47.6	50.1	40.2	44.7	48.9	52.7	56.1	59.0	20

Length in Feet.	8 x 10 INCHES.								8 x 12 INCHES.								Length in Feet.
	Thickness of Metal in Inches.								Thickness of Metal in Inches.								
	¾	⅞	1	1⅛	1¼	1⅜	1½	1¾	¾	⅞	1	1⅛	1¼	1⅜	1½	1¾	
7	107.5	123.1	137.9	152.1	165.6	178.5	190.7	213.2	121.2	139.0	156.1	172.5	188.2	203.2	217.5	244.3	7
8	103.4	118.2	132.3	145.8	158.4	179.8	182.2	203.3	116.7	133.7	150.0	165.6	180.4	194.6	208.2	233.3	8
9	99.1	113.1	126.5	139.3	151.3	162.7	173.4	193.1	112.0	128.2	143.6	158.4	172.4	185.8	198.5	221.9	9
10	94.6	108.0	120.6	132.6	143.9	154.6	164.6	182.9	107.2	122.5	137.1	151.0	164.3	176.8	188.7	210.5	10
11	90.2	102.8	114.7	126.0	138.5	146.5	155.9	172.7	102.3	118.8	130.6	143.7	156.1	167.9	178.9	199.1	11
12	85.8	97.6	108.8	119.4	129.3	138.6	147.3	162.9	97.4	111.1	124.1	136.4	148.0	159.0	169.3	188.0	12
13	81.4	92.6	103.1	113.0	122.2	130.9	138.9	153.3	92.6	105.6	117.8	129.3	140.2	150.4	160.0	177.3	13
14	77.2	87.7	97.6	106.8	115.5	123.5	130.9	144.2	88.0	100.1	111.6	122.4	132.6	142.1	151.0	167.0	14
15	73.1	83.0	92.2	100.9	108.9	116.4	123.2	135.5	83.4	94.9	105.7	115.8	125.3	134.1	142.4	157.2	15
16	69.2	78.5	87.2	95.2	102.7	109.7	116.1	127.4	79.1	89.9	100.0	109.5	118.3	126.6	134.2	147.9	16
17	65.5	74.2	82.3	89.9	96.9	103.3	109.2	119.7	75.0	85.1	91.6	103.4	111.7	119.4	126.5	139.2	17
18	62.0	70.2	77.8	84.8	91.3	97.3	102.8	112.5	71.0	80.5	89.4	97.7	105.5	112.6	119.2	131.0	18
19	58.6	66.3	73.5	80.1	86.1	91.7	96.8	105.8	67.2	76.2	84.6	92.4	99.6	106.2	112.4	123.3	19
20	55.5	62.7	69.4	75.6	81.3	86.5	91.2	99.5	63.7	72.1	80.2	87.3	94.0	100.3	106.0	116.1	20

Length in Feet.	8 x 14 INCHES.								8 x 16 INCHES.								Length in Feet.
	Thickness of Metal in Inches.								Thickness of Metal in Inches.								
	¾	⅞	1	1⅛	1¼	1½	1¾	2	¾	⅞	1	1⅛	1¼	1½	1¾	2	
7	134.9	154.9	174.2	192.8	210.6	244.3	275.1	303.3	148.5	170.8	192.2	213.0	233.0	270.9	306.0	338.2	7
8	130.0	149.2	167.6	185.2	202.2	234.0	263.1	289.4	143.3	164.6	185.1	204.9	223.9	259.8	292.8	323.0	8
9	124.9	143.1	160.6	177.4	193.4	223.4	250.6	275.0	137.8	158.1	177.6	196.4	214.4	248.4	279.2	307.3	9
10	119.6	137.0	153.6	169.4	184.6	212.6	238.0	260.6	132.1	151.4	169.9	187.7	204.7	236.5	265.4	291.4	10
11	114.3	130.8	146.4	161.4	175.6	201.9	225.4	246.3	126.3	144.6	162.2	179.0	195.0	224.8	251.6	275.7	11
12	109.0	124.5	139.3	153.4	166.7	191.3	213.1	232.4	120.6	137.9	154.5	170.3	185.3	213.2	238.1	260.3	12
13	103.8	118.4	132.4	145.6	158.1	181.0	201.2	218.9	114.9	131.3	146.9	161.7	175.8	201.8	225.0	245.5	13
14	98.7	112.5	125.6	138.0	149.6	171.0	189.7	206.0	109.3	124.8	139.5	153.4	166.6	190.9	212.4	231.2	14
15	93.7	106.7	119.0	130.6	141.6	161.4	178.8	193.8	103.9	118.5	132.3	145.4	157.8	180.4	200.3	217.6	15
16	88.9	101.2	112.7	123.6	133.9	152.3	168.4	182.2	98.7	112.4	125.4	137.7	149.3	170.3	188.8	204.7	16
17	84.3	95.9	106.7	116.9	126.5	143.7	158.6	171.3	93.7	106.6	118.8	130.4	141.2	160.8	177.9	192.6	17
18	80.0	90.8	101.0	110.6	119.5	135.6	149.3	161.0	88.9	101.1	112.6	123.4	133.5	151.8	167.7	181.2	18
19	75.9	86.0	95.6	104.6	112.9	127.9	140.7	151.5	84.3	95.8	106.6	116.8	126.2	143.3	158.1	170.6	19
20	71.9	81.5	90.5	98.9	106.8	120.7	132.6	142.6	80.0	90.8	101.0	110.5	119.4	135.4	149.1	160.6	20

Length in Feet.	10 x 12 INCHES.								10 x 14 INCHES.								Length in Feet.
	Thickness of Metal in Inches.								Thickness of Metal in Inches.								
	1	1¼	1½	1¾	2	2¼	2½	2¾	1	1¼	1½	1¾	2	2¼	2½	2¾	
7	182.0	220.9	257.1	290.7	321.8	350.3	376.2	399.8	200.9	244.4	285.2	323.3	358.9	391.8	422.2	450.0	7
8	177.2	214.8	249.6	281.9	311.6	338.8	363.5	385.8	195.7	237.8	277.2	313.9	347.9	379.4	408.3	434.7	8
9	172.0	208.1	241.7	272.6	300.9	326.7	350.1	371.0	190.1	230.7	268.6	303.8	336.3	366.3	393.6	418.5	9
10	166.5	203.0	233.4	262.8	289.7	314.2	336.2	355.9	184.3	223.3	259.7	293.2	324.2	352.6	378.4	401.8	10
11	160.8	194.1	224.8	252.9	278.3	301.4	322.1	340.5	178.2	215.7	250.4	282.5	311.8	338.6	363.0	384.9	11
12	155.1	186.9	216.1	242.8	266.9	288.5	307.9	325.0	172.0	207.9	241.0	271.5	299.3	324.6	347.4	367.8	12
13	149.3	179.7	207.5	232.7	255.4	275.8	293.8	309.8	165.7	200.0	231.6	260.5	286.8	310.6	331.9	351.0	13
14	143.5	172.4	198.8	222.6	244.0	263.2	280.0	294.8	159.4	192.2	222.2	249.6	274.4	296.7	316.7	334.4	14
15	137.7	165.3	190.3	212.8	233.0	250.8	266.6	280.3	153.2	184.4	212.9	238.8	262.2	283.1	301.8	318.3	15
16	132.0	158.3	182.0	203.2	222.2	238.9	253.6	266.3	147.1	176.8	203.8	228.3	250.3	270.0	287.4	302.7	16
17	126.5	151.5	173.9	193.9	211.7	227.4	241.0	252.8	141.0	169.3	195.0	218.1	238.8	257.2	273.4	287.6	17
18	121.1	144.8	166.0	184.9	201.6	216.3	229.0	239.9	135.2	162.1	186.4	208.2	227.7	244.9	260.1	273.3	18
19	115.9	138.4	156.5	176.3	192.0	205.7	217.6	227.7	129.5	155.0	178.1	198.7	917.0	233.1	247.3	259.6	19
20	110.8	132.2	151.2	188.0	182.8	195.6	206.7	216.1	123.9	148.2	170.0	189.5	206.8	221.9	235.1	246.5	20
21	106.0	126.3	144.3	160.1	174.0	186.0	196.3	205.1	118.6	141.7	162.4	180.8	197.0	211.2	223.5	234.1	21
22	101.3	120.6	137.6	152.7	165.7	176.9	186.6	194.7	113.5	135.5	155.1	172.4	187.7	201.1	212.6	222.4	22
23	96.9	115.2	131.4	145.5	157.7	168.3	177.3	184.8	108.7	129.5	148.1	164.5	178.9	191.4	202.2	211.4	23
24	92.7	110.0	125.4	138.7	150.3	160.2	168.6	175.6	104.0	123.8	141.5	157.0	170.5	182.3	192.4	200.9	24
25	88.6	105.1	119.6	132.3	143.2	152.5	160.3	166.9	99.5	118.4	135.1	149.8	161.3	173.7	183.1	191.1	25

Safe Loads in Tons of 2,000 Lbs. for Hollow Cylindrical Cast Iron Columns.

Length in Feet.	4 INCH DIAMETER.			5 INCH DIAMETER.					6 INCH DIAMETER.							
	Thickness of Metal in Inches.								Thickness of Metal in Inches.							
	⅝	¾	⅞	⅝	¾	⅞	1	1⅛	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½
7	10.9	19.0	20.7	27.2	31.2	34.6	37.8	40.4	38.1	44.1	49.7	54.8	59.4	63.6	67.3	70.6
8	14.7	16.4	17.3	24.5	27.9	31.0	33.6	35.9	35.1	40.6	45.6	50.1	54.2	57.9	61.2	64.0
9	12.8	14.3	15.5	22.0	25.0	27.7	30.0	31.9	32.3	37.2	41.7	45.7	49.4	52.6	55.4	58.0
10	11.2	13.4	13.5	19.7	22.4	24.7	26.7	28.4	29.6	34.0	38.1	41.6	44.9	47.7	50.2	52.4
11	9.8	10.9	11.8	17.7	20.0	22.1	23.8	25.3	27.0	31.1	34.7	37.9	40.8	43.3	45.6	47.4
12	8.7	9.6	10.3	15.9	18.0	19.8	21.3	22.5	24.7	28.4	31.6	34.5	37.0	39.3	41.2	42.8
13	7.7	8.5	9.1	14.3	16.2	17.8	19.1	20.2	22.6	25.9	28.9	31.4	33.7	35.7	37.4	38.8
14	6.9	7.5	8.1	13.0	14.6	16.0	17.2	18.2	20.8	23.7	26.4	28.7	30.7	32.5	34.0	35.3
15	6.1	6.7	7.3	11.7	13.2	14.5	15.5	16.4	19.0	21.8	24.1	26.2	28.1	29.6	31.0	32.1
16				10.7	12.0	13.1	14.0	14.8	17.5	20.0	22.1	24.0	25.6	27.1	28.3	29.3
17				9.7	10.9	12.0	12.8	13.5	16.2	18.4	20.3	22.0	23.5	24.8	25.9	26.8
18				8.9	10.0	10.9	11.6	12.3	14.9	16.9	18.7	20.3	21.5	22.8	23.7	24.6
19				8.2	9.2	10.0	10.7	11.2	13.7	15.6	17.3	18.7	19.9	21.0	21.8	22.6
20				7.5	8.4	9.2	9.8	10.3	12.7	14.5	16.0	17.3	18.4	19.3	20.2	20.6
21																
22																
23																
24																
25																

Length in Feet.	7 INCH DIAMETER.								8 INCH DIAMETER.								Length in Feet.
	Thickness of Metal in Inches.								Thickness of Metal in Inches.								
	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	¾	⅞	1	1⅛	1¼	1⅜	1½	1¾	
7	49.1	57.3	65.0	72.2	78.9	85.1	90.9	96.2	70.4	80.3	89.7	98.6	106.9	114.8	122.2	135.5	7
8	46.0	53.7	60.8	67.4	73.5	79.2	84.4	89.1	66.8	76.1	84.9	93.2	100.9	108.2	115.0	127.3	8
9	43.0	50.0	56.6	62.6	68.2	73.4	78.1	82.3	63.2	71.9	80.1	87.7	94.9	101.7	107.9	119.1	9
10	40.1	46.6	52.6	58.1	63.2	67.8	73.0	75.8	59.6	67.7	75.3	82.4	89.0	95.2	100.9	111.1	10
11	37.3	43.2	43.7	53.7	58.4	62.6	66.3	69.8	56.0	63.5	70.6	77.2	83.3	88.9	94.2	103.4	11
12	34.6	40.1	45.1	49.7	53.9	57.6	61.1	64.1	52.6	59.6	66.1	72.2	77.8	83.0	87.7	96.1	12
13	32.1	37.1	41.7	45.9	49.7	53.1	56.2	59.0	49.3	55.8	61.8	67.4	72.6	77.3	81.7	89.8	13
14	29.8	34.4	38.6	42.4	45.9	49.0	51.8	51.2	46.2	52.2	57.8	63.9	67.7	72.0	76.0	82.9	14
15	27.7	31.9	35.8	39.2	42.4	45.2	47.7	49.9	43.2	48.8	54.0	58.7	63.1	67.1	70.7	77.0	15
16	25.7	29.6	33.1	36.3	39.2	41.8	44.0	46.0	40.5	45.7	50.4	54.8	58.9	62.5	65.8	71.6	16
17	23.9	27.5	30.7	33.7	36.3	38.6	40.7	49.5	37.9	42.7	47.2	51.2	54.9	58.4	61.4	66.8	17
18	22.2	25.5	28.5	31.2	33.6	35.8	37.7	39.3	35.5	40.0	44.1	47.9	51.3	54.4	57.2	62.0	18
19	20.7	23.8	26.5	29.0	31.2	33.2	34.9	36.4	33.3	37.5	41.3	44.8	47.9	50.8	53.4	57.8	19
20	19.3	22.1	24.7	27.0	29.0	30.8	32.4	33.8	11.2	35.1	38.7	41.9	44.8	47.5	49.9	53.8	20
21									29.3	33.0	36.3	39.3	42.0	44.4	46.6	50.4	21
22									27.6	30.9	34.0	36.8	39.4	41.6	43.7	47.1	22
23									25.9	29.1	32.0	34.6	37.0	39.1	41.0	44.1	23
24									24.4	27.4	30.1	32.5	34.7	36.7	38.4	41.4	24
25									23.0	25.8	28.3	30.6	32.7	34.5	36.2	38.9	25

Length in Feet.	9 INCH DIAMETER.								10 INCH DIAMETER.							
	Thickness of Metal in Inches.								Thickness of Metal in Inches.							
	¾	⅞	1	1⅛	1¼	1½	1¾	2	⅞	1	1¼	1½	1¾	2	2¼	2½
7	83.5	95.5	107.1	118.1	128.6	148.1	165.7	181.3	101.2	124.3	150.1	173.9	195.7	215.5	233.4	249.5
8	80.0	91.5	102.4	112.9	122.8	141.1	157.5	172.0	97.8	119.8	144.5	167.2	187.8	206.5	223.3	238.3
9	76.4	87.3	97.6	107.5	116.8	134.0	149.3	162.6	94.1	115.2	138.7	160.2	179.6	197.2	212.9	226.8
10	72.8	83.0	92.8	102.0	110.8	126.8	140.9	153.3	90.3	110.4	132.7	153.0	171.3	187.7	202.3	215.2
11	69.1	78.8	87.9	96.6	104.8	119.7	132.8	144.1	86.5	105.5	126.6	145.7	162.9	178.2	191.8	203.7
12	65.5	74.6	83.2	91.3	98.9	112.8	124.8	135.2	82.7	100.6	120.6	138.6	154.6	168.9	181.5	192.4
13	62.0	70.5	78.6	86.2	93.2	106.1	117.2	126.8	78.9	95.8	114.6	131.5	146.6	159.8	171.4	181.5
14	58.6	66.6	74.1	81.2	87.8	99.7	110.0	118.7	75.1	91.2	108.9	124.7	138.7	151.0	161.7	171.0
15	55.4	62.9	69.9	76.5	82.6	93.7	103.2	111.3	71.5	86.6	103.3	118.1	131.2	142.6	152.5	161.0
16	52.3	59.3	65.9	72.0	77.8	88.0	96.7	104.1	68.0	82.2	97.9	111.8	124.0	134.6	143.7	151.5
17	49.3	55.9	62.1	67.8	73.1	82.6	90.7	97.5	64.6	78.0	92.8	105.8	117.1	127.0	135.4	142.6
18	46.6	52.7	58.5	63.8	68.8	77.6	85.1	91.3	61.3	74.0	87.8	100.0	110.6	119.8	127.6	134.2
19	43.9	49.7	56.1	60.1	64.8	73.0	79.9	85.6	58.2	70.2	83.2	94.6	104.5	113.0	120.3	126.4
20	41.5	46.9	52.0	56.7	61.0	68.6	75.0	80.3	55.3	66.6	78.8	89.5	98.8	106.7	113.4	119.0
21	39.2	44.3	49.0	53.4	57.4	64.6	70.5	75.4	52.5	63.1	74.7	84.7	93.4	100.8	107.0	112.2
22	37.0	41.8	46.3	50.4	54.2	60.8	66.3	70.8	49.9	59.9	70.8	80.2	88.3	95.2	101.0	105.8
23	35.0	39.5	43.7	47.6	51.1	57.3	62.4	66.6	47.4	56.8	67.2	76.0	83.6	90.0	95.4	99.8
24	33.2	37.4	41.3	41.9	48.2	54.1	58.9	62.8	45.1	54.0	63.7	72.0	79.1	85.1	90.2	94.3
25	31.4	35.4	39.1	42.5	45.6	51.0	55.5	59.2	42.9	51.3	60.4	68.3	75.0	80.6	85.3	89.1

Length in Feet.	11 INCH DIAMETER.								12 INCH DIAMETER.								Length in Feet.
	Thickness of Metal in Inches.								Thickness of Metal in Inches.								
	1	1¼	1½	1¾	2	2¼	2½	2¾	1	1¼	1½	1¾	2	2¼	2½	2¾	
7	141.3	171.4	199.5	225.5	249.6	271.7	291.8	310.1	158.2	192.5	224.8	255.1	283.4	309.7	334.0	356.4	7
8	137.1	166.1	193.1	218.0	240.9	261.9	281.0	298.2	154.2	187.5	218.7	247.9	275.1	300.4	323.6	345.0	8
9	132.6	160.4	186.3	210.0	231.8	251.7	269.7	285.8	149.9	182.1	212.2	240.3	266.4	290.4	312.6	332.9	9
10	127.9	154.6	179.2	201.8	222.4	241.2	258.1	273.2	145.3	176.4	205.3	232.3	257.2	280.1	301.1	320.3	10
11	123.1	148.6	172.0	193.4	212.9	230.5	246.3	260.4	140.6	170.5	193.3	224.0	247.7	269.5	289.4	307.5	11
12	118.2	142.5	164.7	185.0	203.4	219.9	234.6	247.7	135.8	164.5	191.0	215.6	238.2	258.8	277.6	294.6	12
13	113.4	136.4	157.5	176.6	193.9	209.4	223.1	235.2	131.0	158.4	183.8	207.2	228.6	248.1	265.8	281.8	13
14	108.5	130.5	150.4	168.4	184.6	199.1	211.9	223.1	126.1	152.3	176.5	198.8	219.0	237.5	254.1	269.1	14
15	103.8	124.6	143.4	160.4	175.6	189.1	201.0	211.4	121.3	146.3	169.4	190.4	209.6	227.0	242.7	256.7	15
16	99.2	118.9	136.7	152.7	166.9	179.5	190.6	200.3	116.5	140.4	162.3	182.3	200.5	916.8	231.5	244.6	16
17	94.7	113.3	130.2	145.2	158.5	170.3	180.6	189.5	111.8	134.6	155.4	174.4	191.5	207.0	220.7	233.0	17
18	90.3	108.0	123.9	138.0	150.5	161.5	171.1	179.3	107.2	128.9	148.7	166.7	182.9	197.4	210.3	221.8	18
19	86.1	102.9	117.9	131.2	142.9	153.2	162.1	169.7	102.7	123.4	142.2	159.2	174.6	188.2	200.4	211.1	19
20	82.1	98.0	112.1	124.6	135.6	145.2	153.5	160.6	98.4	118.1	136.0	152.1	166.6	179.4	190.8	200.8	20
21	78.3	93.3	106.7	118.5	128.8	137.8	145.5	152.1	94.3	113.0	130.0	145.2	158.9	171.0	181.7	191.1	21
22	74.6	88.9	101.5	112.6	122.3	130.7	137.9	144.0	90.3	108.1	124.2	138.7	151.6	163.0	173.1	181.8	22
23	71.2	84.6	96.6	107.0	116.2	124.0	130.8	136.5	86.4	103.4	118.7	132.4	144.6	155.4	164.8	173.1	23
24	67.9	80.6	91.9	101.8	110.4	117.8	124.1	129.4	82.8	99.0	113.5	126.5	138.0	148.2	157.1	164.8	24
25	64.8	76.9	87.5	96.9	104.9	111.9	117.8	122.7	79.2	94.7	108.5	120.8	131.7	141.3	149.7	156.9	25

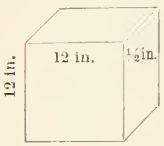
Corrosion of Steel and Iron

C=Coefficient of Corrosion during 1 year's exposure in pounds avoirdupois per square foot. (For value of C see table.)
W=Weight in pounds of 1 foot in length of section exposed.
L=Length in feet of the perimeter exposed. If both the inside and outside perimeter are exposed to the Corrosive influence both must be included.
Y‖‡ The number of years of life of the metal.
Formula $Y=\frac{W}{C\ L}$

Table of Value of C.

Y‡ is based on the assumption that the metal is tolerably uniform in thickness, otherwise the thin portion will have a shorter life than the rest of the section.	Corroding Agents.					
	Foul Sea Water.	Clear Sea Water.	Foul River Water.	Pure Air or Clear River Water.	Air of City Manufacturing District or Sea Water.	Sea Water of Average Foulness.
Cast Iron	.0656	.0635	.0381	.0113	.0476	.....
Wrought Iron	.1956	.1285	.1440	.0123	.1254	.....
Steel	.1914	.0970	.1133	.0125	.1252	.....
Cast Iron, planed	.2301	.0888	.0728	.0109	.0884	.....
" " galvanized	.0895	.0359	.0371	.0371	.0199	.....
" " in contact with brass	.....	.....	.....	.....	.....	.1908
" " " " " copper	.....	.....	.....	.....	.....	.2003
" " " " " gun metal	.....	.....	.....	.....	.....	.3493
Best Wrought Iron in contact with brass	.....	.....	.....	.....	.....	.2779
" " " " " " copper	.....	.....	.....	.....	.....	.4012
" " " " " " gun metal	.....	.....	.....	.....	.....	.4537

Example=Steel.



W=12-in. x 12-in. x ½-in. x .283=20.376 pounds.

L=1 ft. 0-in.

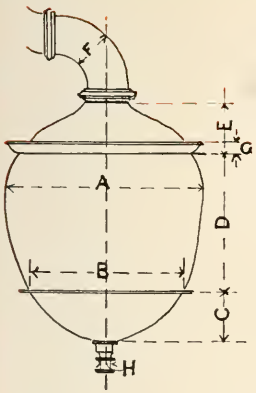
C=.1252 from table.

$$Y=\frac{W}{C\ L}=\frac{20.376}{1\times 1252}=\frac{20.376}{.1252}=62.667 \text{ years.}$$

The corrosion of steel unprotected in manufacturing districts of cities would therefore amount to 20.38 pounds in 162.67 years of the above dimensions of block of steel, or in that time it would be entirely consumed by oxidization.

NAILS REQUIRED FOR DIFFERENT KINDS OF WORK.

For 1,000 shingles, 3½ to 5 lbs. 4*d*. nails, or 3 to 3½ lbs. 3*d*.
For 1,000 laths, about 7 lbs. 3*d*. fine.
For 1,000 feet clapboards, about 18 lbs. 6*d*. box.
For 1,000 feet covering boards, about 20 lbs. 8*d*. common, or 25 lbs. 10*d*.
For 1,000 feet upper floors, square edged. about 38 lbs. 10*d*. floor, or 41 lbs. 12*d*. floor.
For 1,000 feet upper floors, matched and blind-nailed, 38 lbs. 10*d*., or 42 lbs. 12*d*. common.
For 10 feet partitions, studs or studding, 1 lb. 10*d*. common.
For 1,000 feet furring, 1x3, about 45 lbs. 10*d*. common.
For 1,000 feet furring, 1x2, about 65 lbs. 10*d*. common.
For 1,000 feet pine finish, about 30 lbs. 8*d*. finish.
For roofs and gutters use seven-pound lead; for hips and ridges, six-pound; for flashings, four-pound.
Gutters should have a fall of at least one inch in ten feet.
No sheet lead should be laid in greater length than ten or twelve feet without a dip to allow for expansion.
Joints to lead pipes require a pound of solder for every inch in diameter.



Memoranda for Breweries.

Kettle Measures

Barrels	A	B	C	D	E	F	G	H
50	8'6"	7'-	2'-	5'-	2'-	2'-	6"	3"
100	10'6"	8'6"	2'6"	6'-	2'6"	"	8"	4"
150	11'6"	9'3"	"	7'6"	"	2'6"	"	"
200	12'6"	10'-	2'10"	8'6"	2'10"	"	10"	5"
250	13'6"	10'6"	3'-	9'6"	3'-	"	"	"
300	14'6"	11'-	"	10'-	"	3'-	12"	"
350	15'-	11'-	3'6"	10'6"	4'-	"	"	"
400	16'-	12'-	4'-	11'-	"	"	"	"

Capacities for Appliances

Kettle	50 barls.	100 barls.	150 barls.	200 barls.	250 barls.	300 barls.	400 barls.
Mash-tub	11'- x 5'-	12'- x 6'-	14'- x 6'-	15'- x 6'6"	16'- x 6'-	17' x 7'	18' x 7'
Hop-jack	7' x 8' x 5'	8' x 9'6"	10' x 12'6"	11' x 14' 6"	12' x 14' 6.6	14' x 15' x 7'	14' x 15' x 7.6"
Meal hopper	8' x 4' x 4'	8' x 6' 4'	9' x 7' 4.6	10' 7' 6" 5'	10' 8' x 5'	11' 8' 5.6"	12' 10' 6'
Beer tank	8' 6" x 5'	10' x 6"	12' x 6"	14' x 6'	15' 6'	16' x 6' 6"	18' x 7'
Water tank	8' 8' 25 bar	10' 9' 165 bar	12' 9' 240 bar	13' 10' 315 bar	14' 10' 6" 380 B	15' 11' 460 B	16' 13' 6" 620 B
Brand's cooler Lengths of	27 tubes 14' long	34 tubes 16' long	42 tubes 16' long	42 tubes 18' long	42 tubes 20' long	48 tubes 20' long	2 ea 42 tubes 18' long
Grain tank " hopper	6' x 6' x 3' 6" 4'-	8' x 8' x 4' 6" 5'-	8' 10' x 5' 5' 6"	10' 10' x 5' 6"	10' 12' x 6" 6' 0"	11' 13' x 6' 6' 6"	12' 15' x 7' 7' 0"

Weights of Materials.

Dry Woods.

	Lbs. Board ft.	Lbs. Cubic ft.		Lbs. Board ft.	Lbs. Cubic ft.
Apple	4.1	49.	Iron Wood	6.	71.
Ash, American white	3.9	47.	Larch	3.	35.
Birch	3.9	45.	Lignum vitæ	6.9	83.
Beech	3.7	43.	Mahogany, Honduras	2.9	35.
Boxwood	5.	60.	Mahogany, Spanish	4.4	53.
Cedar, American	2.9	35.	Maple	4.1	49.
Cedar, W. Indian	3.9	47.	Maple, soft	3.5	42.
Cedar, Lebanon	2.5	30.	Oak, live	4.9	59.3
Cherry	3.5	42.	Oak, red	3.9	45.
Chestnut	3.4	41.	Oak, white	4.3	52.
Cork	1.3	15.	Pine, Southern	3.7	45.
Elm	2.9	35.	Pine, white	2.1	25.
Ebony	6.3	76.1	Pine, yellow	2.8	34.3
Hemlock	2.1	25.	Spruce	2.1	25.
Hickory	4.4	53.	Sycamore	3.1	37.
Hornbeam	2.9	47.	Walnut	3.2	38.

Building Materials.

	Lbs Cubic ft.		Lbs. Cubic ft.
Brick, pressed	150	Granite or limestone, rubble work	138
Brick, common	125	Granite or limestone, well dressed	165
Cement, Portland	80 to 100	Limestones and marbles	168
Cement, Rosedale	56	Lime, quick	53
Common brickwork, cement mortar	130	Mortar, hardened	103
Common brickwork, lime mortar	120	Plaster of paris	141.6
Concrete cement	140	Sand	90-106
Earth dry, shaken	82 to 92	Sandstone	151
Earth, rammed	92 to 100	Shales	162
Glass, window	157	Slate	175
Granite	170	Trap rock	187

WOODEN BEAMS.

Table of safe quiescent loads for horizontal rectangular beams one inch thick, supported at both ends, the load equally distributed.

SPAN IN FEET	DEPTH OF BEAM IN INCHES.										
	6	7	8	9	10	11	12	13	14	15	16
5	800	1090	1420	1800	2220	2690	3200	3750	4350	5000	5690
6	670	910	1180	1500	1850	2240	2670	3130	3630	4170	4740
7	570	780	1010	1290	1590	1920	2280	2680	3110	3570	4060
8	500	680	890	1120	1390	1680	2000	2350	2720	3130	3560
9	440	600	790	1000	1210	1490	1780	2090	2420	2780	3160
10	400	540	710	900	1110	1340	1600	1880	2180	2500	2840
11	360	490	650	820	1010	1220	1450	1710	1980	2270	2590
12	330	450	590	750	930	1120	1330	1560	1810	2080	2370
13	310	420	550	690	850	1030	1230	1440	1680	1920	2190
14	290	390	510	640	790	960	1140	1340	1560	1790	2030
15	270	360	470	600	740	900	1070	1250	1450	1670	1900
16	250	340	440	560	690	840	1000	1170	1360	1560	1780
17	230	320	420	530	650	790	940	1100	1280	1470	1670
18	220	300	400	500	620	750	890	1040	1210	1390	1580
19	210	290	380	470	590	710	840	990	1150	1320	1500
20	200	270	360	450	560	670	800	940	1090	1250	1420
21	190	260	340	430	530	640	760	890	1040	1190	1350
22	180	250	320	410	500	610	730	850	990	1140	1290
23	170	240	300	390	480	580	700	810	950	1090	1230
24	160	230	290	370	460	560	670	780	910	1040	1180
25	160	220	280	350	440	540	640	750	870	1000	1130
26	150	210	270	340	420	520	610	720	840	960	1090
27	150	200	260	330	400	500	590	690	810	920	1050
28	140	190	250	320	490	480	570	670	780	890	1010
29	140	190	250	310	380	460	550	650	750	860	980
30	130	180	240	300	370	450	530	630	730	830	950

This table has been calculated for extreme fiber strain of 1,000 lbs. per square inch, giving a safety of 6 in ordinary building timber of fair quality.

Oak and yellow pine will carry a load one-fourth greater.

When more accuracy is required the weight of the beam itself must be deducted.

Care must be taken to let the beams rest for a sufficient distance on their supports to guard against crushing at the ends, especially in placing very heavy loads upon short, but deep and strong beams.

FORMULAE FOR ASCERTAINING STRENGTH OF BEAMS.

To ascertain the strength of a beam of any given size, or materials, multiply its width (in inches) by the square of the depth (in inches) and divide by the span (in feet)—multiply the quotient by the constant (co-efficient of strength) of material used, and the result will be the breaking load.

In ordinary practice a sixth of the "breaking" would be a "safe load."

$$\text{Center breaking load in lbs.} = \frac{\text{Width in inches} \times \text{sq. of depth in inches}}{\text{Clear span in feet}} \times \text{constant*}$$

Example: To ascertain the safe centre load in lbs. for a white pine beam 8 inches wide, 12 inches deep, 16 feet clear span.

$$\frac{\text{Width (in inches)} \times \text{square of depth (in inches)}}{\text{Clear span (in feet)}} \times \frac{\text{constant*}}{\text{factor of safety.}}$$

or

$$\frac{8 \times 144}{16} \times \frac{450*}{6} = 5{,}400 \text{ lbs.}$$

* Constants or transverse strengths in lbs. for center loads are:

American white pine.....450 lbs.

American yellow pine.....550 lbs.

American white oak.....600 lbs.

Constants are for loads at rest.

Where beam is loaded at the center to get neat load, deduct ½ weight of beam.

Where beam is uniformly loaded the strength is double, to get neat load deduct entire weight of beam.

LIMES, CEMENTS, PLASTERS.

Limes and Cements.—Natural limes and cements are produced by calcining limestones and other calcareous materials, in which process the carbonic acid and moisture they contain are driven off.

Hydraulic Limes are calcined from stone containing 73 to 92 per cent. of carbonate of lime, and a portion of clay, also soluble silica, carbonate of magnesia, alkalies, metallic oxides, and sulphates.

Cements.—There is no precise line between hydraulic limes and cements, the latter containing a larger proportion of clay than limes.

Natural Cements are calcined from stones containing carbonate of lime, a mixture of carbonate of lime and magnesia, together with a proportion of from 30 to 50 per cent. of clay. More than 40 per cent. of clay is injurious to the cements.

Hydraulic Cements are artificial cements made in a similar manner to hydraulic lime, but with a larger proportion of clay, silica, alumina, magnesia, etc. They do not slack after calcination, and some set under water at a temperature of 65 degrees in from 3 to 5 minutes and others in as many hours.

Portland Cement is an artificial cement. Good cement should be ground very fine, and should weigh from 95 to 130 pounds to the striked bushel. Slow setting cement is strongest. It is very important that sand used with cement be perfectly clean and sharp.

Mortar is lime and sand mixed with water. The setting process is a chemical change, the lime and the carbonic acid in the air combining to form a carbonate of lime, which as a cementing element encloses and binds together the particles of sand. The sand should be perfectly free from clay, loam or other impurities, or substitutes for sand may be used in the shape of well burnt clay, coriae from iron-works, slag from furnaces and cinders from coals.

Gypsum, or hydrated sulphate of lime is the basis of most plasters. It is a soft stone, which is either simply calcined, or calcined and combined with salts and alkalies.

Plaster of Paris is gypsum gently calcined till nearly the whole of the moisture is driven off. It can be cast in almost any form in wax or guttapercha moulds. It is also used with other plasters to quicken the setting.

Keene's Cement is plaster of paris soaked in a solution of alum and recalcined.

Parian Cement is gypsum calcined and powdered and mixed with a solution of borax, recalcined, ground, and mixed with a solution of alum.

Coarse Stuff is lime water mixed with hair or fiber.

Fine Stuff is lime slaked to a paste run to the consistency of cream, and allowed to harden to the required consistency for working by evaporation.

Gauged Stuff is plaster of paris added in the proportion of about 1 to 4 for its more rapid setting.

Rough Cast is washed gravels mixed with hot hydraulic lime; it is thrown with large trowels in a semi-fluid state upon an even surface of coarse stuff, and colored with lime wash and ochre.

Depeter is a "pricked up" coat of coarse stuff, into which small stone are pressed while in a wet state.

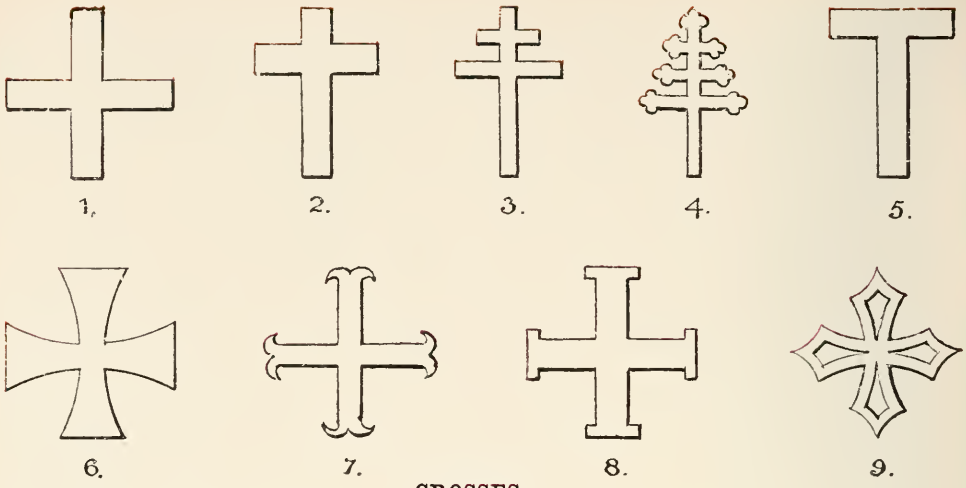
Depretor is plaster finished with a surface similar to cooled stone.

Pugging is coarse stuff put between floors for the purpose of deafening.

Papier Mache is paper reduced to a pulp or sheets of paper glued together and pressed in a metal mould to a required form.

Carton Pierre is similar to papier mache, but made with paper pulp, whiting and size, pressed into plaster moulds.

Fibrous Plaster is plaster of Paris in a thin coat laid on canvas strained on framework.



CROSSES.

The cross, a symbol of Christianity, has very naturally been extensively used in the monuments of the middle ages. When the two branches of the cross are equal in length, as in Fig. 1, the cross is called a Greek cross, and when the stem is longer than the arms, as in Fig. 2, it is a Roman or Latin cross. When the figure has two arms, one longer than the other, as in Fig. 3 (the upper one meant as a representation of the inscription which was placed over the head of Christ) it is known by the name of the Lorraine cross, and has received that name from its being a bearing in the arms of the Dukes of Lorraine. By heralds this is called a patriarchal cross. The next cross, whose arms are triple, as Fig. 4, is the papal cross, and is one of the emblems of the papacy, signifying, perhaps, like the triple crown or tiara, the triple sovereignty over the universal church, the suffering church and the triumphant church. The great majority of the western churches, with transepts, are constructed in the form of the Latin cross, those in the form of the Greek cross being very rare. Those in the form of the Lorraine cross are still rarer, and rarer are those constructed with triple transepts. There is another form called the truncated or tau cross, as Fig. 5, having the form of that letter, on which, as a plan, a few churches have been built. Considered as respects the contour, the cross in blason has been variously shaped and named. Thus, Fig. 6, in which the extremities widen as they recede from the center, is called a cross patee. This is met with more frequently than any of the others. It is seen in the nimbus, on tombs, on shields, upon coins, etc.; and is the usual form of the dedication cross found in religious structures. Fig. 7 is by the French called ancree, the extremities forming hooks, but by heralds it is called the cross moline. Crosses flory are those in which the ends are formed into trefoils, as is seen in Fig. 4, the papal cross above mentioned. Fig. 8 is a cross potent, and Fig. 9 is the cross clechee, as respects the outer lines of its form; when it is voided, as shown by the inner lines, the ground or field is seen on which it lies.

MEASUREMENT OF OLD BRICKS.

Uncleaned rough from building dumped from 8-10.
Uncleaned stacked on outside and interior filled promiscuously, 10-12.
Cleaned and stacked, 16-18.
Cleaned, stacked on outside and interior filled promiscuously, 12-14.

RULE FOR CALCULATING PROPORTIONED WIDTH AND HEIGHT OF TREADS AND RISES OF STAIRS

Subtract the width of tread from 24 in. and the result will be twice the height of the riser. Thus: if the tread is 10 in. wide, then $24 - 10 = 14 \div 2 = 7$ in., the height or riser proportionate to a 10 in. tread. This is exclusive of nosings.

MEMORANDA FOR PAINTERS.

(From "Builders' Guide and Price Book.")

Painters' work is generally estimated by the yard, and the cost depends upon the number of coats applied, besides the quality of the work, and the material to be painted.

One coat or priming, will take, for 100 yards of painting, twenty pounds of lead and four gallons of oil. Two-coat work, forty pounds of lead and four gallons of oil. Three-coat work, the same proportionate quantity as two coats; so that a fair estimate for 100 yards of three-coat would be 100 pounds of lead and sixteen gallons of oil.

One gallon priming oil color will cover 50 superficial yards.

One pound of paint covers about four superficial yards the first coat, and about six each additional coat. One pound of putty, for stopping every twenty yards.

One gallon of tar and one pound of pitch will cover twelve yards superficial the first coat, and seventeen yards each additional coat.

A day's work on the outside of a building is 100 yards of first coat, and 80 yards of either second or third coat. An ordinary door, including casings, will, on both sides, make eight to ten yards of painting, or about five yards to a door without casings. An ordinary window makes about two and one-half or three yards.

RULE FOR FINDING THE REQUIRED AREA FOR ANY CHIMNEY.

Multiply the nominal horse-power of the boiler by 112, and divide the product by the square root of the height of the chimney in feet. The quotient will be the required area in inches, at the top of chimney.

Table showing diameter and height of chimney for any boiler:

Horse-Power of Boiler.	Height of Chimney in feet.	Interior Diameter at top.	Horse-Power of Boiler.	Height of Chimney in feet.	Interior Diameter at top.
10	60	14 in.	70	120	30 in.
12	75	14 "	90	120	34 "
16	90	16 "	120	135	38 "
20	99	17 "	160	150	43 "
30	105	21 "	200	165	47 "
50	120	26 "	250	180	52 "
60	120	27 "	380	195	57 "

WEIGHT OF BRICKWORK.

Placing the weight of brickwork at 112 lb. per cubic foot, the weights per superficial foot for different walls are:

9 inch wall..... 84 lb.
13 inch wall..... 121 lb.
18 inch wall..... 168 lb.
22 inch wall..... 205 lb.
26 inch wall..... 243 lb.

ACOUSTICS.

The effect of length, height and width of rooms on their acoustics.—A writer in the "Arch. and Bldr." says: "To half the width of room add height of platform and height of the speaker, for height of room from floor to ceiling. The length of room from speaker may be $1\frac{1}{2}$ to twice the width, but should not exceed 90 ft." From examples of halls which have proved exceptionally successful for music, it appears that the height which would be far too great for a building for public speaking seems distinctly favorable for musical effect. A ratio of height to width and length should be as 2, 3 and 5, these proportions having proved eminently successful for music halls. For theaters no person should be over 70 feet from the speaker. The best shape for an auditorium is probably horse-shoe.

TO FIND THE RADIUS OF AN ARCH.

Centers—The following is the method to find the radius for arch centers S = span R = rise

Then $\left\{ \dfrac{\left(\frac{S}{2}\right)^2}{R} + R \right\} \div 2$ or: To the square of half the span divided by the rise, add the rise and divide this sum by 2, and the result will be the radius required.

Example:—Suppose an arch 20 feet span and 5 feet rise then:

$$\left\{ \frac{10^2}{5} + 5 \right\} \div 2 = \frac{20 + 5}{2} = 12 \text{ ft. } 6 \text{ in. the radius required.}$$

IRON GIRDERS.

The equal corresponding weight in the center of a girder caused by a certain ascertained weight coming at any other point of the same girder.

W = Known Weight.
L = The whole length between the bearings.
D = Distance between resting point of W and the furthest support.
D' = Distance between resting point of W and the nearest support.
E = Half the distance between the supports.
x = The equal corresponding weight or strain in the center.

Then $x = \dfrac{W\,E}{D}$

Example.—Let A B be a girder 12 ft. long with a girder resting on it 4 ft. from A with a known resultant weight of 5 tons, then x or strain at C (center)

$$= \frac{5 \times 6}{8} \text{ or } 3\tfrac{3}{4} \text{ tons.}$$

To resolve the weight W into the two concurrent parallel forces at A and B, or the resultant weight or strain at the bearings. Taking the above example.

Strain at B $= \dfrac{W\,D'}{L}$ or $\dfrac{5 \times 4}{12} = 1\tfrac{2}{3}$ tons. Strain at A $= \dfrac{W\,D}{L}$ or $\dfrac{5 \times 8}{12}$ or $3\tfrac{1}{3}$ tons.

When a beam is fixed at one end only, and has to support a weight uniformly distributed over the length the form of equal strength is a triangle, supposing the beam to be everywhere the same, but if the section of beam be circular, then the form of equal strength will be a semi-cubic parabola.

A cast iron girder if made too deep will be too rigid, and a comparatively small impulsive force will break it, the outline of the compressed side or top flange of a C. I. girder if to bear a weight uniformly distributed should be an arch the radius of which equals the square of half the length divided by the depth or

$\left(\frac{L}{2}\right)^2 \div d$ where L = length of Girder between the bearings.
d = depth of Girder.

If the depth is obliged to be uniform then the outline of the breadth should be formed by setting two parabolas base to base, their verticals being in the middle of the length.

HINTS ABOUT PAINTING IRON.

Before painting iron, it should be thoroughly scraped, brushed and cleaned from all scale or rust.

Lead paints should not be applied to iron, as they erode the surface of the metal instead of protecting it. Oxide of iron paint is found both theoretically and practically to be anti-corrosive.

VELOCITY OF WIND.

10 miles, per square foot,	0.49 lbs.	50 miles, per square foot,	12.304 lbs.
20 miles, per square foot,	1.97 lbs.	60 miles, per square foot,	17.733 lbs.
30 miles, per square foot,	4.43 lbs.	70 miles, per square foot,	24.153 lbs.
40 miles, per square foot,	7.87 lbs.	100 miles, per square foot,	49.200 lbs.

LIQUID MEASURE.

31½ gallons = 1 barrel.
2 barrels = 1 hogshead.
1 barrel = 4⅓ cubic feet.
8.665 cubic inches = 1 gill.
4 gills = 1 pint = 33.6 c. inches.
2 pints = 1 quart = 67.2 c. inches.
4 quarts = 1 gallon = 268.8 c. inches.
1 gallon U. S. = 8.34 lb.
1 gallon U. S. = 231 cubic inches.
1 cubic foot = 7.48 U. S. gallons.

DRY MEASURE.

1 barrel pork = 200 pounds.
1 barrel fish = 200 pounds.
1 barrel flour = 196 pounds.
1 barrel salt = 280 pounds.
1 barrel beef = 200 pounds.
1 bushel corn = 56 pounds.
1 bushel oats = 30 to 33½ pounds.
1 bushel wheat = 60 pounds.
1 bushel potatoes = 60 pounds.
2 gallons = 1 peck.
8 gallons = 1 bushel.
64 gallons = 1 quarter.
1 bushel = 1.28 cubic feet.
1 cubic foot corn = 42 pounds.
1 cubic foot rice = 48 pounds.
1 cubic foot hops = 27 pounds.
1 carload = 680 bushels.
1 c. foot Anthr. coal = 54 lbs.
1 ton Anthr. coal = abt. 40 c. ft.

PAPER.

24 sheets = 1 quire.
20 sheets = 1 quire outsides.
25 sheets = 1 quire printers.
20 quires = 1 ream.
21½ quires = 1 ream printers'.
2 reams = 1 bundle.
10 reams = 1 bale.
60 skins = 1 roll of parchment.

WEIGHTS AND MEASURES—LINEAL MEASURE.

2¼ inches = 1 nail.
4 inches = 1 hand.
3 inches = 1 palm.
9 inches = 1 span.
12 inches = 1 foot.
45 inches = 1 ell.
3 feet = 1 yard.
6 feet = 1 fathom.
16½ feet or 5½ yards = 1 rod, pole, or perch.
4 poles or 22 yards = 1 chain.
220 yards or 40 poles = 1 furlong.
1760 yards or 8 furlongs = 1 mile.
7.92 inches = 1 link.
100 links or 66 ft. = 1 chain.
10 chains = 1 furlong.
80 chains = 1 mile.
3 miles = 1 league.
240 yards = 1 cable length.
6086.07 feet = 1 knot or sea mile.

LENGTH OF A FOOT IN DIFFERENT COUNTRIES.

	Inches.		Inches.
Spain	11.03	Denmark	12.35
Holland	11.14	Prussia	12.36
Sweden	11.14	Austria	12.45
America	12	Portugal	12.96
England	12	Russia	13.75

LENGTH OF A MILE IN DIFFERENT COUNTRIES.

	Am. yards.		Am. yards.
Russian	1,100	Spanish	5,028
Italian	1,467	German	5,866
English	1,760	Swedish and Danish	7,233
American	1,760	Hungarian	8,630
Scotch	1,984	Norwegian	12,400
Irish	2,200	French league	3,666
Polish	4,400		

SQUARE MEASURE.

144 square inches = 1 square foot.
9 square feet = 1 square yard.
272¼ feet = 1 square rod or pole.
40 rods = 1 square rood.
4 roods, 160 rods, 4,840 yards, 43,560 feet, 10 square chains = 1 acre.
640 acres = 1 square mile.

2,471 acres = 1 hectare.
7,840 square yards = 1 Irish acre.
6150 square yards = 1 Scotch acre.
30 square acres = 1 yard of land.
100 acres = 1 hide of land.
40 hides = 1 barony.
36 sq. miles = 1 township.
640 acres = 1 section.
About 14 25x125 ft. lots = 1 acre.

SOLID OR CUBIC MEASURE.

1728 cubic inches = 1 cubic foot.
27 cubic feet = 1 cubic yard.
40 cubic feet of rough or 50 cubic feet of hewn timber = 1 ton or load.

108 cubic feet = 1 stack of wood.
128 cubic feet = 1 cord of wood.
40 c. ft. = 1 U. S. A. shipping ton.
42 c. ft. = 1 British shipping ton.

AVOIRDUPOIS WEIGHT.

16 drachms = 1 ounce.
16 ounces = 1 pound.
28 pounds = 1 quarter.

112 pounds = 1 cwt.
20 cwt. = 1 ton.

TROY WEIGHT.

24 grains = 1 dwt.
20 dwt. = 1 oz.

12 oz. = 1 lb.

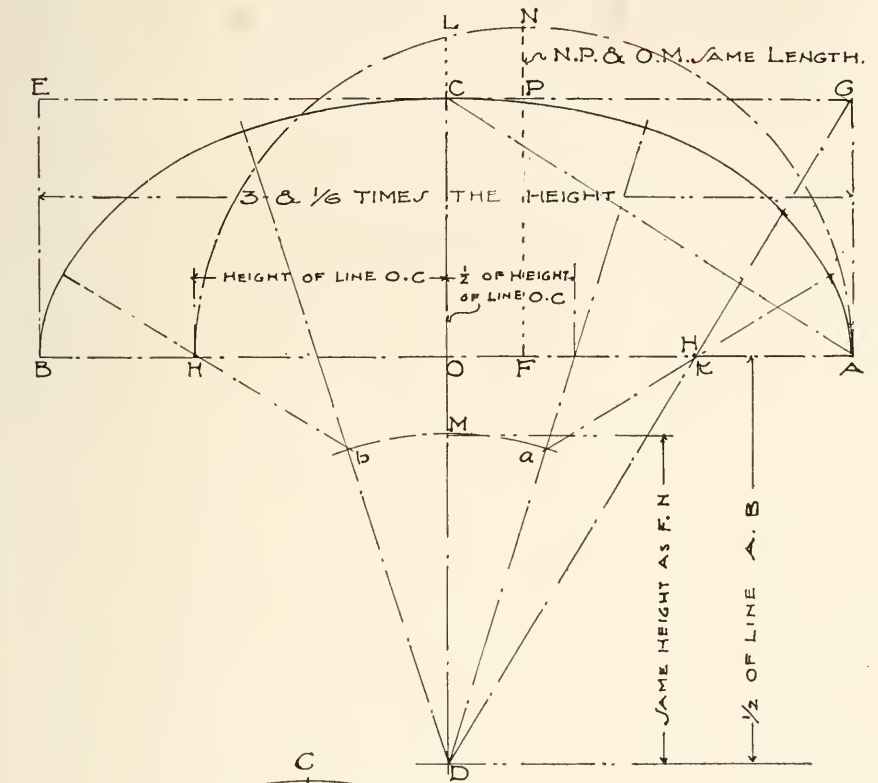
SIZES OF PAPER (Whatman's).

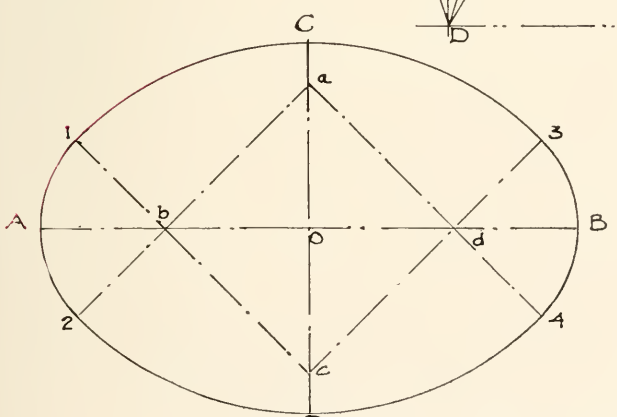
	Inches.		Inches.
Emperor	72 x 48	Royal	24 x 19
Antiquarian	53 x 31	Medium	22 x 17½
Double elephant	40 x 26¾	Demy	20 x 15½
Atlas	34 x 26	Large post	20¾ x 16¾
Colombier	34½ x 23½	Post	19 x 15¼
Imperial	30 x 22	Foolscap	17 x 13½
Elephant	28 x 23	Post	15 x 12½
Super royal	27 x 19	Copy	20 x 16

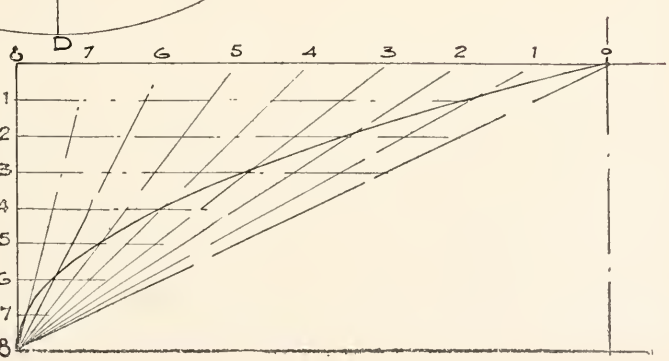
TABLE OF SQUARE ROOTS.

No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root.	No.	Sq. Root
25	5.	650	25.46	1400	37.42	2600	50.99
50	7.071	700	26.46	1450	38.08	2700	51.96
75	8.66	750	27.39	1500	38.73	2800	52.91
100	10.00	800	28.28	1550	39.37	2900	53.85
125	11.18	850	29.15	1600	40.00	3000	54.77
150	12.25	900	30.00	1650	40.62	3200	56.57
175	13.23	950	30.82	1700	41.23	3400	58.30
200	14.14	1000	31.62	1800	42.43	3600	60.00
250	15.81	1050	32.40	1900	43.59	3800	61.64
300	17.32	1100	33.16	2000	44.72	4000	63.24
350	18.70	1150	33.91	2100	45.82	4200	64.80
400	20.00	1200	34.64	2200	46.90	4400	66.32
450	21.21	1250	35.36	2300	47.95	4600	67.82
500	22.36	1300	36.06	2400	48.99	4800	69.28
550	23.45	1350	36.74	2500	50.00	5000	70.72
600	24.49						

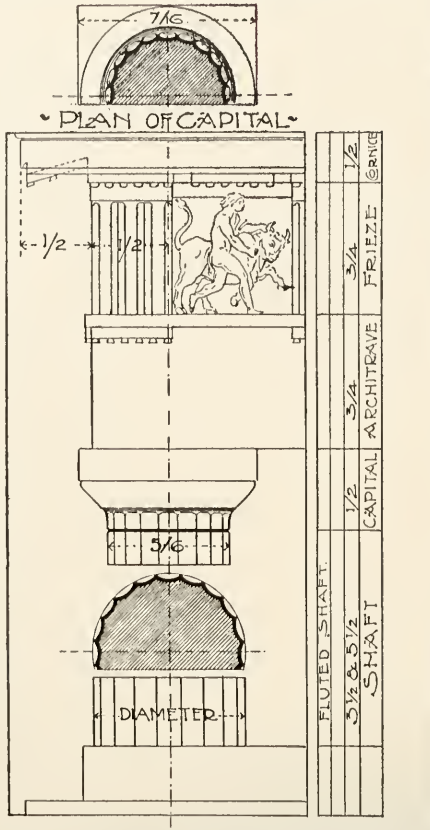
PROBLEMS ON THE ELLIPSE & PARABOLA.







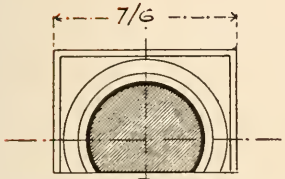
GREEK-DORIC COMPARISON OF THE ORDERS



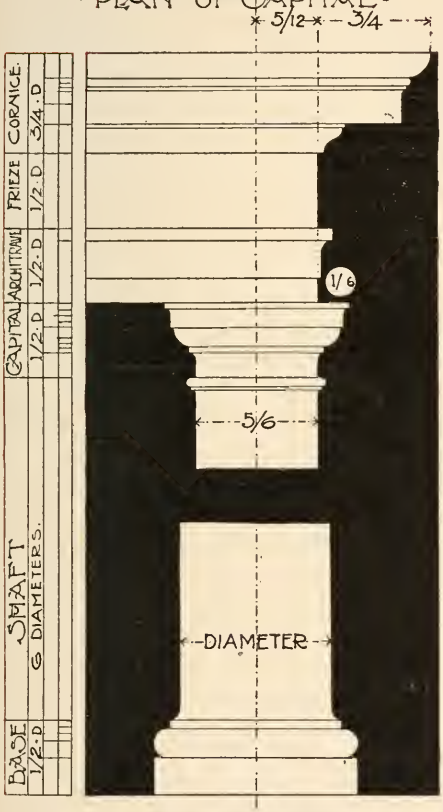
ELEVATION OF COLUMN CAPITAL & ENTABLATURE

NAMES OF FEATURES			GREEK-DORIC		TUSCAN		DORIC		IONIC		CORINTHIAN COMPOSITE	
ENTABLATURE	CORNICE	CYMATIUM CORONA BED MOULD	2	1/2	1¾	3/4	2	3/4	2¼	7/8	2½	1
	FRIEZE			3/4		1/2		3/4		6/8		3/4
	ARCHITRAVE	TÆNIA		3/4		1/2		1/2		5/8		3/4
COLUMN	CAPITAL	ABACUS ECHINUS NECKING	4-6	1/2	7	1/2	8	1/2	9	1/3	10	7/6
	SHAFT	ASTRAGAL								1/2		
		CINCTURE										
	BASE	BASE MOULD PLINTH		NONE		1/2		1/2		1/2		1/2
PEDESTAL	CAP	CORONA BED MOULD	NO PEDESTAL BUT THREE STEPS THE STYLOBATE		THIS CAP IS ONE NINTH THE HEIGHT OF THE PEDESTAL							
	DIE				PEDESTAL ⅓ HEIGHT OF COLUMN. [VIGNOLA] ~Alex A. Fuller Del.~							
	BASE	BASE MOULD PLINTH			THE BASE IS TWO NINTHS THE HEIGHT OF PEDESTAL							

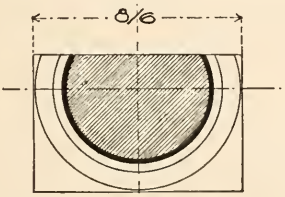
TUSCAN ORDER



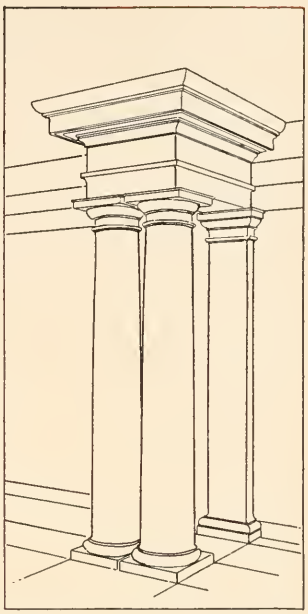
PLAN OF CAPITAL



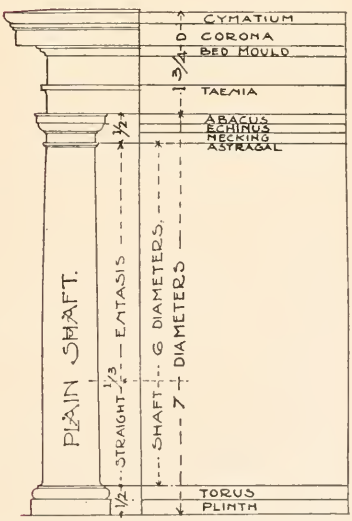
ELEVATION OF BASE CAPITAL & ENTABLATURE



PLAN OF BASE



PERSPECTIVE VIEW



COMPLETE ORDER

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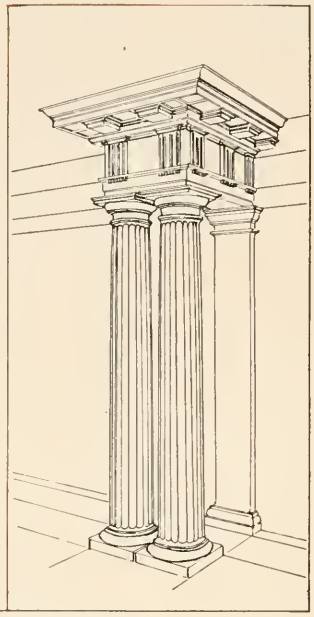
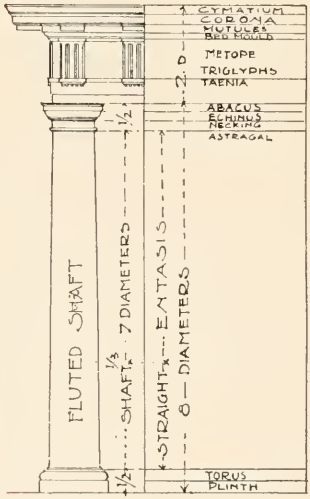
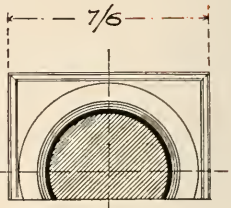
DORIC ORDER



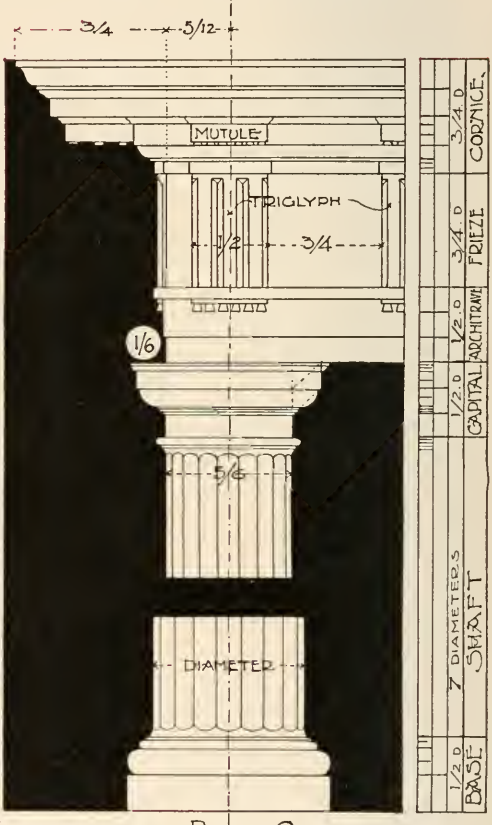
PERSPECTIVE VIEW



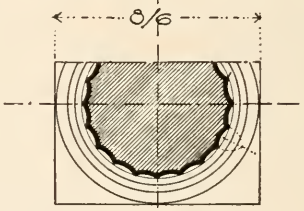
COMPLETE ORDER



PLAN OF CAPITAL



ELEVATION OF BASE CAPITAL & ENTABLATURE



PLAN OF BASE

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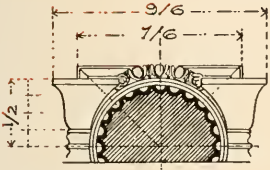
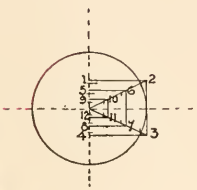
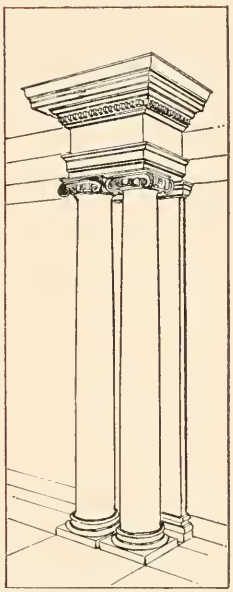
IONIC ORDER

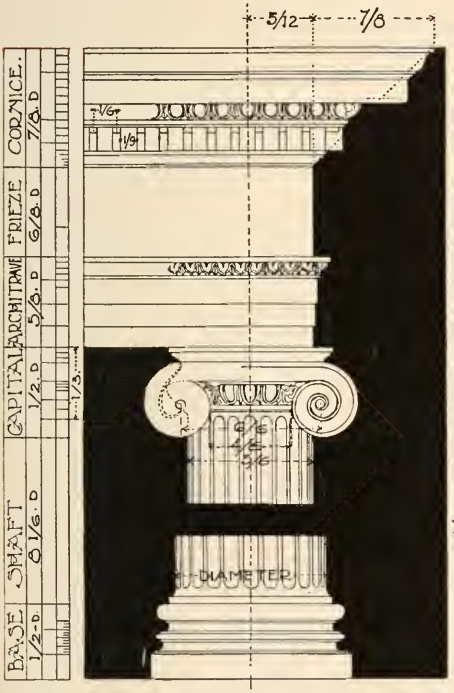


PLAN OF CAPITAL

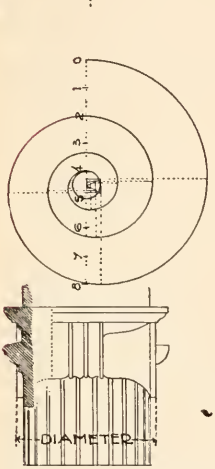




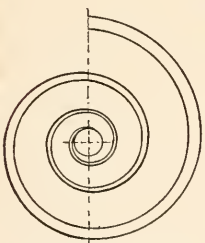
PERSPECTIVE VIEW



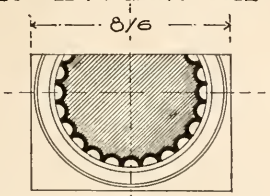
ELEVATION OF BASE CAPITAL & ENTABLATURE



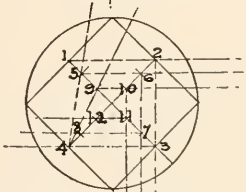
SIDE OF CAPITAL



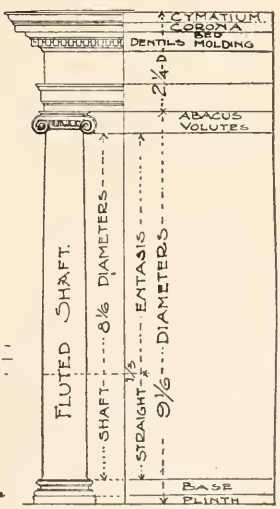
VOLUTE



PLAN OF BASE



EYE OF VOLUTE



COMPLETE ORDER

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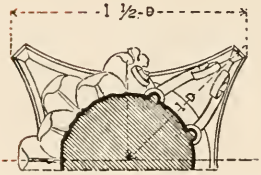
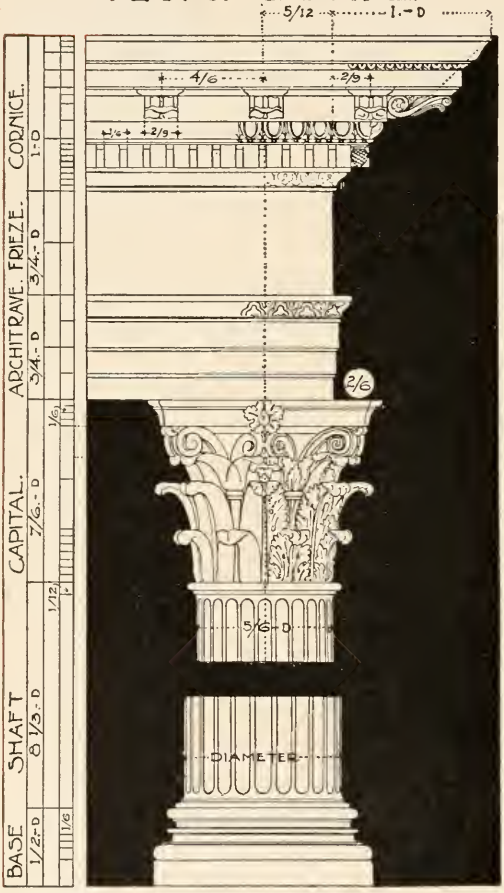
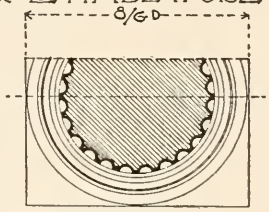
CORINTHIAN ORDER.



~PLAN OF CAPITAL~



~ELEVATION OF BASE CAPITAL~
~& ENTABLATURE~



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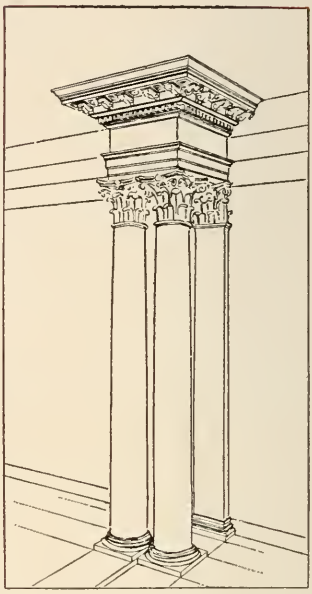

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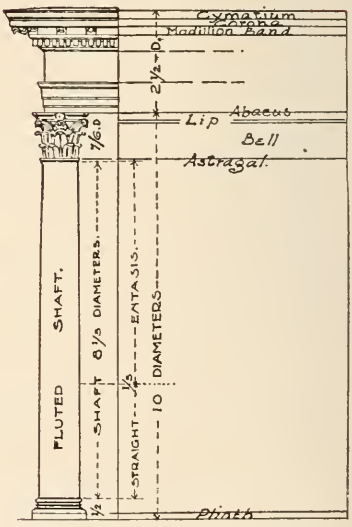

COMPLETE ORDER.

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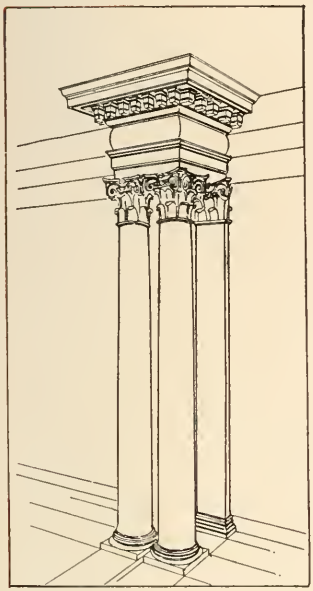
COMPOSITE ORDER



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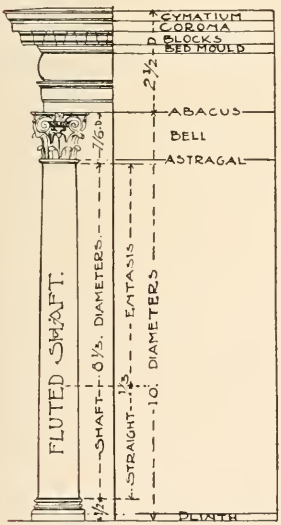

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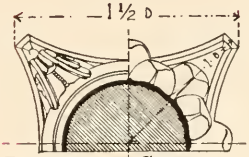

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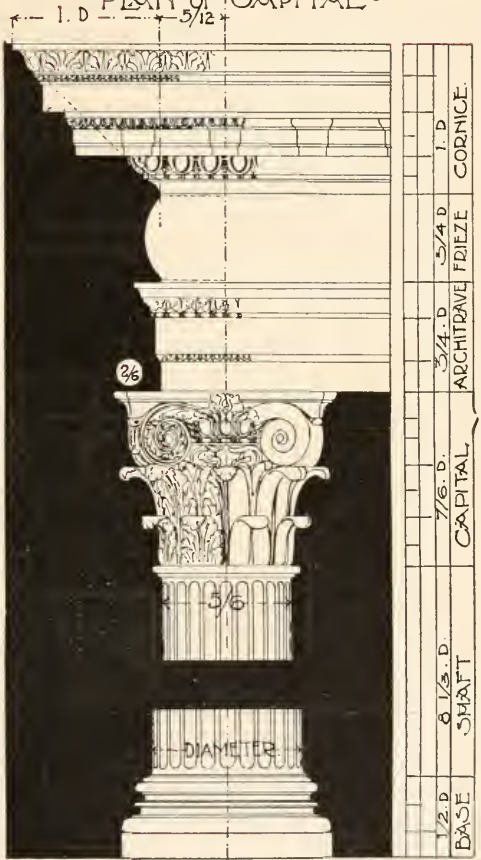
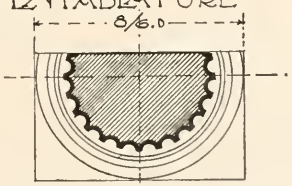


ELEVATION OF BASE CAPITAL & ENTABLATURE



PLAN OF BASE

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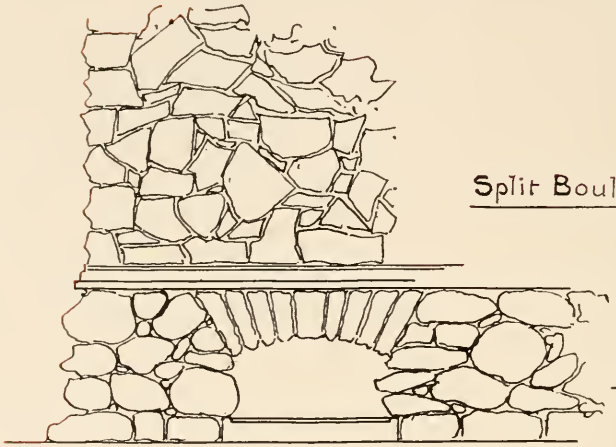
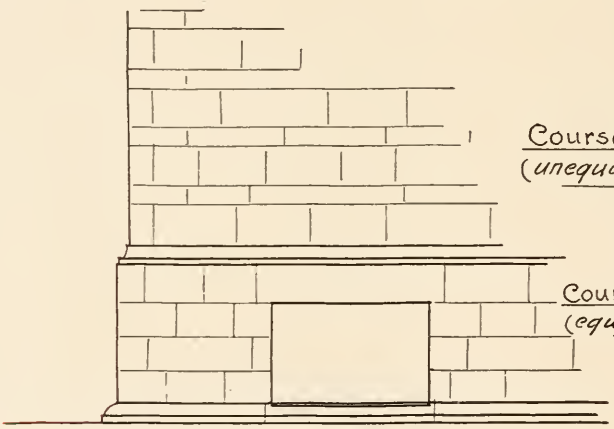
Suggestions for Setting Stone.



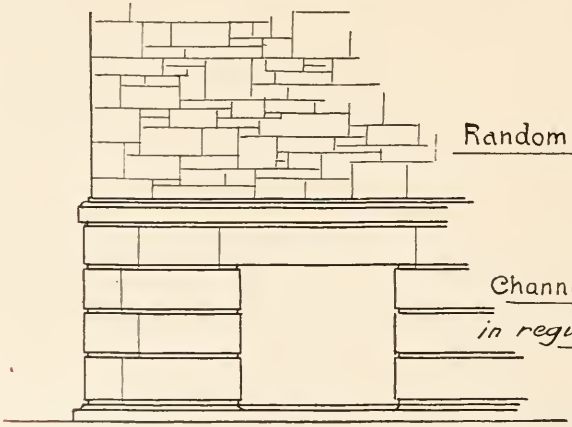
Split Boulder Work

Boulder Work.



Coursed Ashlar.
(*unequal heights*)

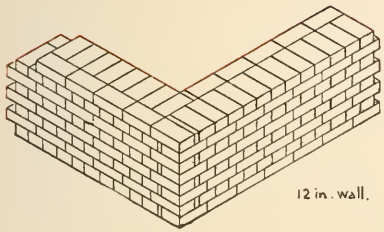
Coursed Ashlar.
(*equal heights*)

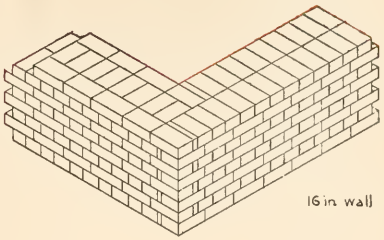


Random Range.

Channeled joint
in regular courses.

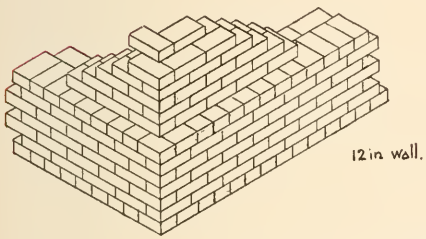
Bonds Used in Laying Brickwork.

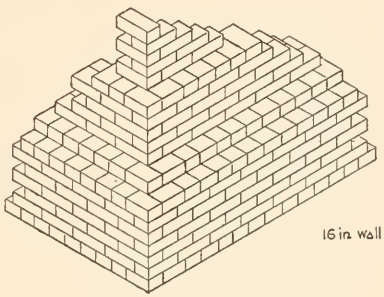




English Bond.

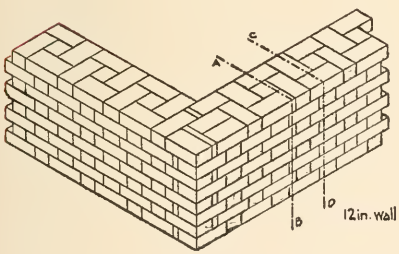
One row of headers and one of stretchers in alternate courses.

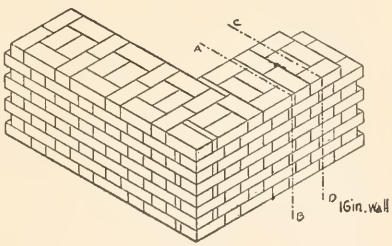




Chicago Bond.

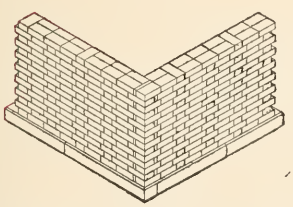
One row of headers and five courses of stretchers.





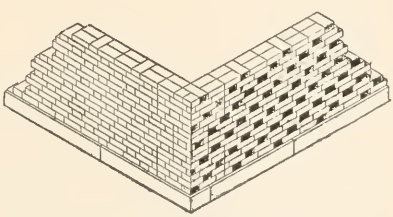
Flemish Bond.

Headers and stretchers alternating in each course.



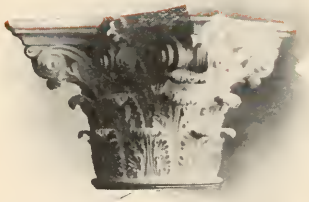
English Garden Wall Bond.

Three stretchers and one header alternating in each course.



German Cross Bond.

Two stretchers and one header alternating in each course.



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FIRE ESCAPES A SPECIALTY.

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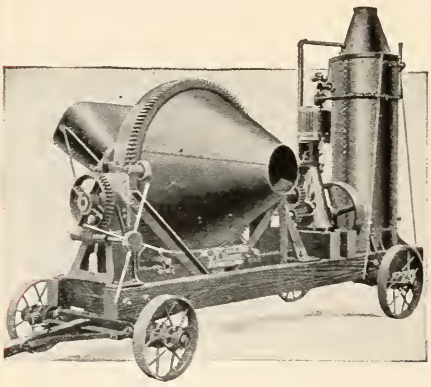

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Chicago Portland Cement Co., Stock Exc. Bldg.
Dee, Wm. E., Co., 214 and 215 Royal Ins. Bldg.
Garden City Sand Co., The, 188 Madison St.
Illinois Steel Co., (Cement Dept.), The Rookery.
Jenkins & Reynolds Co., The, 1210 Cham. Com.
Knickerbocker Ice Co., 171 La Salle St.
Lake Shore Sand Co., 308 Chamber of Com.
Meacham & Wright, 308-09 Chamber of Com.
Mississippi Valley Portland Cement Co., The, First Nat'l Bank Bldg.
Peerless Portland Cement Co., Union City, Mich.; Chicago Office, 92 La Salle St.
Ready & Gallaghan Coal Co., 47th and Halsted.
Whitehall Portland Cement Co., 172 East Washington St.

CEMENT—AMERICAN AND IMPORTED.

Garden City Sand Co., The, 188 Madison St.
Meacham & Wright, 308-09 Chamber of Com.

CEMENT—HYDRAULIC.

Garden City Sand Co., The, 188 Madison St.
Knickerbocker Ice Co., 171 La Salle St.
Moulding, Thomas Co., Chamber of Commerce.

CEMENT—MANUFACTURERS.

Atlas Portland Cement Co., 204 Dearborn St.
Chicago Portland Cement Co., Stock Exc. Bldg.
Illinois Steel Co., (Cement Dept.), The Rookery.
Peerless Portland Cement Co., Union City, Mich., Chicago Office, 92 La Salle St.
Whitehall Portland Cement Co., 172 East Washington St.

CEMENT PAVING AND FLOORS.

Blome, Rudolph S. Co., 79 Dearborn St.
Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Hoeffer & Co., Chamber of Commerce Bldg.
International System, S. M. Randolph, 1005 Chamber of Commerce Bldg.
McEvoy, Wm. P. & Co., 414 Reaper Block.
Peterson, John, & Co., 171 Washington St.

CEMENT—PORTLAND.

Atlas Portland Cement Co., 204 Dearborn St.
Chicago Portland Cement Co., Stock Exc. Bldg.
Garden City Sand Co., The, 188 Madison St.
Illinois Steel Co., (Cement Dept.), The Rookery.
Jenkins & Reynolds Co., The, 1210 Cham. Com.
Knickerbocker Ice Co., 171 La Salle St.
Meacham & Wright, 308-09 Chamber of Com.
Mississippi Valley Portland Cement Co., The, First Nat'l Bank Bldg.
Moulding, Thomas Co., Chamber of Commerce.
Peerless Portland Cement Co., Union City, Mich., Chicago Office, 92 La Salle St.
Whitehall Portland Cement Co., 172 East Washington St.

CEMENT SIDEWALKS, PAVING AND FLOORS.

Blome, Rudolph S. Co., 79 Dearborn St.
Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Gilbert, Harry S., 232 Lunt Av., Rogers Park.
Hoeffer & Co., Chamber of Commerce Bldg.
International System, S. M. Randolph, 1005 Chamber of Commerce Bldg.
Johnson & Stokes, 901 Security Bldg.
McEvoy, Wm. P. Co., 414 Reaper Blk.
Peterson, John, & Co., 171 Washington St.
Simpson Construction Co., 704 Cham. of Com.
Union Building Material Co., 509 Chamber of Commerce.

CEMENT—UTICA HYDRAULIC.

Garden City Sand Co., The, 188 Madison St.
Meacham & Wright, 308-09 Chamber of Com.

CEMENT AND CONCRETE CONSTRUCTION.

Blome, Rudolph S. Co., 79 Dearborn St.
Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Hoeffer & Co., Chamber of Commerce Bldg.
International System, S. M. Randolph, 1005 Chamber of Commerce Bldg.
McEvoy, Wm. P. & Co., 414 Reaper Block.
Peterson, John, & Co., 171 Washington St.
Simpson Construction Co., 704 Cham. of Com.
Union Building Material Co., 509 Chamber of Commerce.

CHEMISTS.

Hunt, Robert W. & Co., 1121 The Rookery.

CHIMNEY TOPS.

American Clay Products Co., 514, 142 Washington St.
Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

CHIMNEY TOPS—CAST IRON.

Walter, Wm. B. & Co., 545 Marquette Bldg.

CHURCH FURNITURE.

Stafford, E. H. Mfg. Co., 262-264 Wabash Ave.

CLAM-SHELL DREDGES.

Featherstone Foundry & Machine Co., 348 N. Halsted St.

CLOTHES DRYERS.

Chicago Clothes Dryer Works, 346-348 Wabash Av.
Nelson & Krueter Co., Spalding Av. and Bloomingdale Road, 49 S. Clinton St.

COAL DOCK TOWERS.

Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.

COAL HANDLING MACHINERY FOR POWER PLANTS.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Jeffrey Mfg. Co., Monadnock Blk. and Columbus, Ohio.
Link Belt Machinery Co., 39th St. and Stewart Av.
Weller Mfg. Co., 118 East North Ave.

COLD STORAGE WAREHOUSES.

National Fire Proofing Co., 806 Hartford Bldg.

COMPOSITION FOR EXTERIOR AND INTERIOR—ORNAMENTAL.

Architectural Decorating Co., 643 S. Jefferson.
Decorators' Supply Co., The, 215 S. Clinton St.

CONCRETE CONSTRUCTION.

Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Hoeffer & Co., Chamber of Commerce Bldg.
International System, S. M. Randolph, 1005 Chamber of Commerce.
Johnson & Stokes, 901 Security Bldg.
Kahn System, Robert A. Travers, 540 Marquette Bldg.
McEvoy, Wm. P. & Co., 414 Reaper Block.
McNulty Bros., 1455 Railway Exchange Bldg.
Pittsburgh Construction Co., Diamond Bank Bldg., Pittsburgh, Pa.
Raymond Concrete Pile Co., 135 Adams St.
Roebling Construction Co., The, 906 Tribune Bldg.
Simpson Construction Co., 704 Cham. of Com.
Steel Stone Construction Co., 1761 Monadnock.
Trussed Concrete Steel Co., Pittsburg, Pa.
Union Building Material Co., 509 Chamber of Commerce.

CONCRETE FIRE PROOFING.

Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Hoeffer & Co., Chamber of Commerce Bldg.
International System, S. M. Randolph, 1005 Chamber of Commerce.
Kahn System, Robert A. Travers, 540 Marquette Bldg.
Roebling Construction Co., The, 906 Tribune Bldg.
Trussed Concrete Steel Co., Pittsburg, Pa.

CONCRETE MIXERS—CUBE.

Contractors' Supply & Equipment Co., Old Colony Bldg.
Municipal Engineering & Contracting Co., Railway Exchange Bldg.

CONCRETE PILES.

Raymond Concrete Pile Co., 135 Adams St.

CONDUCTOR PIPE.

Illinois Roofing & Supply Co., 23 E. Lake St.

CONSOLES AND MANTELS.

Dawson Bros., 197-207 N. Halsted St.
Interior Woodworking Co., 296 Wabash Av.

CONTRACTORS AND BUILDERS.

Angus Bros. & Co., 908 Security Bldg.
Bulley & Andrews, 411, 115 Dearborn St.
Campbell, Arch M. Co., 197 Madison St.
Clark C. Everett Co., 1405, 100 Washington St.
Conran, Thomas & Co., 49 Plymouth Place.
Cullen, Frank J., 617 Chamber of Commerce.
Davis, Reginald J. Co., The, Suite 1451, Railway Exchange Bldg.
Eilenberger, H., & Co., 153 La Salle St.
Ericsson, John & Henry, 84 La Salle St.
Falkenau Construction Co., 110 La Salle St.
Freeman, Hart & Co., Chamber of Commerce.
Gindele, Chas. W., Co., 3333 La Salle St.
Grace, Wm. Company, 1408 Wabash Av.
Griffiths, John & Son, 1009-1011 Merchants Loan & Trust Bldg.
Johnson, F. O., 84 La Salle St.
Johnson & Stokes, 901 Security Bldg.

Lanquist & Illsley Co., 393 North Clark St.
Leafgreen Construction Co., 145 La Salle St.
Ledgerwood, A. J. C., Rooms 516-517, 184 La Salle St.
Mayor, William, Co., 164 Dearborn St.
McCarty Brothers, 804, 134 Monroe St.
Meiling & Walther, 84 La Salle St.
Moe, Ingwald, 7627 Coles Av.
Morava Construction Co., 1243 Marquette Bldg., 204 Dearborn St.
Morrice & Barron, 125 La Salle St.
Mortimer & Tapper, 145 E. Van Buren St.
Mueller, Paul P. F., 109 Randolph St.
Nelson, F. P. & Son, 715-716 Cham. of Com.
O'Connor, J. P. and J. W., 807 Security Bldg.
Peterson, John, & Co., 171 Washington St.
Scharmer, Jacob, 1007 Chamber of Commerce.
Schlueter, Henry W., 204 Dearborn St.
Snyder, H. V., 813 Chamber of Commerce.
Snyder, J. W., 316, 145 La Salle St.
Sollitt, Ralph & Sumner Co., 140 Dearborn st.
Sproul, Elliott W., 315 Chamber of Commerce.
Strandberg, E. P. Company, 159 La Salle St.
Stresenreuter Bros., 614 Chamber of Commerce.
Thompson-Starrett Co., Railway Exc. Bldg.
Thomson, George & Son Co., 145 La Salle St.
Todd, James & Co., 145 La Salle St.
Trnesdell, F. H., 4360 N. Clark St.
Warren, William H. Mfg. Co., Blackhawk St. and Smith Ave.
Wells Bros. Company, 1014 Monadnock Blk.
Wolfinger, Clarence L., 226 La Salle St.
Zadeck, B. M. Co., 811, 135 Adams St.

CONTRACTORS' SUPPLIES.

Contractors Supply & Equipment Co., Old Colony Bldg.
Municipal Engineering & Contracting Co., Railway Exchange Bldg.

CONVEYORS—SPIRAL STEEL.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Link Belt Machinery Co., 39th St. and Stewart Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

COOLING SYSTEMS FOR BUILDINGS.

Thomas & Smith, 17-19 S. Carpenter St.

COPING.

Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

COPPER ORNAMENTS.

Friedley & Voshardt 194-202 Mather St.

COPPER—SHEET.

Benedict & Burnham Brass & Copper Co., 211-213 Lake St.

CORNER BEAD METAL.

Travers, Robert A., 540 Marquette Bldg.

CORNICE FINIALS.

Illinois Roofing & Supply Co., 23 E. Lake St.

CORNICE MAKERS' ORNAMENTS.

Friedley & Voshardt 194-202 Mather St.
Knisely Co., Harry C., 273 S. Canal St.

CORNICE WORK.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
McFarland, J. C. & Co., 27th St. and 5th Av.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

CORNICES—COPPER.

Miller, Jas. A. & Bro., 129 S. Clinton St.

CORNICES—COPPER, GALVANIZED.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
McFarland, J. C. & Co., 27th St. and 5th Av.
Miller, James A. & Bro., 129 S. Clinton St.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

CORRUGATED IRON.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
McFarland, J. C. & Co., 27th St. and 5th Av.
Miller, James A. & Bro., 129 S. Clinton St.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.
Wheeling, Corrugating Co., 45-47 Lake St.

COTTON TWINES.

Samson Cordage Works, 115 Congress St., Boston, Mass.

CRUSHED STONE DEALERS.

American Crushed Stone Co., 92 La Salle St.
Knickerbocker Ice Co., 171 La Salle St.
Ready & Gallaghan Coal Co., 47th and Halsted.

CURBING—OOLITIC LIME STONE.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.

CUT STONE CONTRACTORS.

Buscher & Gast, 3333 N. Clark St.
Chicago Cut Stone Co., 3403 La Salle St.

CUTLERY AND TOOLS.

Hodge & Homer Co., 47 and 49 W. Randolph.
Orr & Lockett Hardware Co., 71-73 Randolph.

DAMP COURSES.

Bird, F. W. & Son, 1434 Monadnock Blk.
Blome, Rudolph S. Co., 79 Dearborn St.
Patent Vulcanite Roofing Co., 625-659 South Campbell Ave.
Watson, H. F. Co., 12-14 S. Clinton St.

DEADENING FELT—QUILT.

Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.
Johns-Manville Co., H. W., 173 Randolph St.
Watson, H. F. Co., 12-14 S. Clinton St.

DEADENING FELTS.

Patent Vulcanite Roofing Co., 625-659 South Campbell Ave.

DEADENING MATERIAL.

Mackolite Fireproofing Co., 1401-03 Schiller Bldg.

DECORATIVE MOULDINGS.

Moore, Geo. F., 186-188-190 24th St.

DECORATORS.

Spierling & Linden, 1216 Michigan Av.

DECORATORS—THEATER.

Spierling & Linden, 1216 Michigan Av.

DIPPER DREDGES.

Featherstone Foundry & Machine Co., 348 N. Halsted St.

DOOR HANGERS.

Lane Bros. Company, Poughkeepsie, N. Y.

DOOR HANGERS—BALL BEARING.

Lane Bros. Company, Poughkeepsie, N. Y.

DOORS.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Paine Lumber Co., Chamber of Commerce.

DOORS—CROSS HORIZONTAL FOLDING.

Variety Mfg. Co., 77-83 W. Lake St.

DOORS—CROSS IMPROVED MEAKER.

Variety Mfg. Co., 77-83 W. Lake St.

DOORS—RICHMOND COUNTERBALANCE CORRUGATED IRON.

Richmond Safety Gate Co., 1428 Marquette.

DOORS—RICHMOND HORIZONTAL TROLLEY.

Richmond Safety Gate Co., 1428 Marquette.

DOORS—SLIDING SWING.

Dodge, H. B. & Co., 525, 108 La Salle St.

DOORS—VENEERED.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.

DRAINAGE.

Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Wills & Smith, 5938 S. Halsted St.

Muth, Chr., 428 Blue Island Av.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Union Foundry Works, First Nat'l Bank Bldg.
Voss, Frederick, 617 to 621 Austin Av.

FIRE EXTINGUISHERS.

Niagara Fire Extingnisher Co., 226 La Salle.
Phœnix Fire Extinguisher Co., First National Bank Bldg.

FIREPLACE FURNISHINGS, ETC.

Hoops, William H. & Co., 10-12 E. Monroe St.

FIREPROOF FLOORS.

Kahn System, Robert A. Travers, 540 Marquette Bldg.
Trussed Concrete Steel Co., Pittsburg, Pa.

FIREPROOF LATH.

Northwestern Expanded Metal Co., 790 Old Colony Bldg.

FIREPROOF LOCKERS.

Churchill & Spalding, 464-478 Carroll Ave.

FIREPROOF PAINTS—ANTI-FLAME.

Chicago Fire Proof Covering Co., 18 N. Canal St.

FIREPROOF PARTITIONS.

American Clay Products Co., 514, 142 Washington St.
Detroit Fireproofing Tile Co., 904 Ft. Dearborn Bldg. and Detroit, Mich.
Illinois Terra Cotta Lumber Co., 439 The Rookery.
International System, S. M. Randolph, 1005 Chamber of Commerce.
Mackolite Fireproofing Co., 1401-03 Schiller Bldg.
National Fire Proofing Co., 806 Hartford Bldg.
Pioneer Fireproofing Co., 1515 Marquette Bldg.
Roebling Construction Co., The, 906 Tribune Bldg.
Southern Fire Brick & Clay Co., 608 Chamber of Commerce.
Voss, Frederick, 617 to 621 Austin Av.

FIREPROOF SAFES.

Harris, S. H. Co., The, 29 Pearce St.
Herring-Hall-Marvin Safe Co., corner Dearborn and Lake Sts.

FIREPROOF SASH AND FRAMES.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
Voigtman & Company, 42-54 E. Erie St.

FIRE PROOF SHUTTERS AND DOORS.

Dodge, H. B. & Co., 525, 108 La Salle St.
Kinnear Mfg. Co., The, 112 Clark St.
Landon & Eggers, Iron and Wire Works, Contracting office, First Nat'l Bank Bldg.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

FIREPROOF WINDOWS.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
Voigtman & Company, 42-54 E. Erie St.

FIRE PROOF WIRE LATH.

Cannonsburg Iron & Steel Co., Pittsburg, Pa
General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Northwestern Expanded Metal Co., 790 Old Colony Bldg.
Roebling Construction Co., The, 906 Tribune Bldg.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

FIRE PROOFING.

American Clay Products Co., 514, 142 Washington St.
Cannonsburg Iron & Steel Co., Pittsburg, Pa.
Detroit Fireproofing Tile Co., 904 Ft. Dearborn Bldg. and Detroit, Mich.
General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Illinois Terra Cotta Lumber Co., 439 The Rookery.
International System, S. M. Randolph, 1005 Chamber of Commerce.
Johnson & Stokes, 901 Security Bldg.
Kahn System, Robert A. Travers, 540 Marquette Bldg.
Mackolite Fireproofing Co., 1401-03 Schiller Bldg.
National Fireproofing Co., 806 Hartford Bldg.
Pioneer Fireproofing Co., 1515 Marquette Bldg.
Roebling Construction Co., The, 906 Tribune Bldg.
Southern Fire Brick & Clay Co., 608 Chamber of Commerce.
Trussed Concrete Steel Co., Pittsburg, Pa.

FIRE WINDOWS.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.

FLOOR AND ROOF LIGHTS.

Brown Bros. Mfg. Co., 22nd and Campbell Av.

FLOORING—HARDWOOD.

Chandler Lumber Company, 100 Elston Av.
Cooley, Wm. H., 1160, Clybourn Ave.
Hettler, Herman H. Lumber Co., 1324 Elston.
Rittenhouse & Embree Co., 3500 Center Av.
Spry, John Lumber Co., Ashland Av. & 22d St.
Wilce, T. Co., The, 22nd and Throop St.

FLOORING—OAK AND MAPLE.

Hettler, Herman H. Lumber Co., 1324 Elston.

FLOORING—WOOD BLOCK.

Dodge, H. B. & Co., 525, 108 La Salle St.

FLUE LININGS.

American Clay Products Co., 514, 142 Washington St.
Dee, Wm. E. Co., 214 and 215 Royal Ins. Bldg.
Garden City Sand Co., The, 188 Madison St.

FORGINGS.

American Bridge Co., 1315 Monadnock.
Walter, Wm. B. & Co., 545 Marquette Bldg.

FOUNDATIONS—CONCRETE.

Raymond Concrete Pile Co., 135 Adams St.

FOUNDERS.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Featherstone Foundry & Machine Co., 348 N. Halsted St.
Illinois Malleable Iron Co., 30 W. Monroe St.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Link Belt Machinery Co., 39th St. and Stewart Av.
Webster Mfg. Co., 1075 W. 15th St.

FRAMES—WINDOW & DOOR.

Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Paine Lumber Co., Chamber of Commerce.

FRICTION CLUTCHES.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Caldwell, W. E. Co., Louisville, Ky.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Link Belt Machinery Co., 39th St. and Stewart Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

FURNACES.

International Heater Co., 48 Dearborn St.
Lewis & Kitchen, 433 Wabash Av.

FURNITURE—STEEL.

General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Krag Imperial Cabinet Co., Clinton & Monroe.

GALVANIZED AND BLACK SHEETS.

Illinois Roofing & Supply Co., 23 E. Lake St.

GALVANIZED IRON.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.

GARBAGE BURNERS.

Stoddard, Charles F., 52 Dearborn St.

GAS BROILERS.

Detroit Stove Works, 2921 to 2933 S. La Salle St., Chicago, Ill.

GAS ENGINES.

Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
National Meter Co., 318 Dearborn St.

GAS FITTING.

Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Willis & Smith, 5938 S. Halsted St.

GAS FIXTURES.

Edwards, W. S. Mfg. Co., 21 E. Lake St.

GAS—ILLUMINATING.

People's Gas Light & Coke Co., Michigan Av. and Adams St.

GAS LOGS AND GAS GRATES FOR FIRE-PLACES.

Dawson Bros., 197-207 N. Halsted St.
Hoops, William H. & Co., 10-12 E. Monroe St.

GAS—NATURAL.

People's Gas Light & Coke Co., Michigan Av. and Adams St.

GAS RANGES.

Detroit Stove Works, 2921 to 2933 S. La Salle St., Chicago, Ill.

GAS STEAM RADIATORS.

Clow, James B. & Sons, Harrison & Franklin.

GAS WATER HEATERS.

Detroit Stove Works, 2921 to 2933 S. La Salle St., Chicago, Ill.

GAUGES—STEAM.

Marsh, Jas. & Co., 226 Washington St.

GENERAL CONSTRUCTORS.

Pittsburgh Construction Co., Diamond Bank Bldg., Pittsburgh, Pa.

GENERAL CONTRACTORS.

Angus Bros & Co., 908 Security Bldg.
Bulley & Andrews, 411, 115 Dearborn St.
Campbell, Arch M. Co., 197 Madison St.
Clark C. Everett Co., 1405, 100 Washington St.
Conran, Thomas & Co., 49 Plymouth Place.
Cullen, Frank J., 617 Chamber of Commerce.
Eilenberger, H., & Co., 153 La Salle St.
Ericsson, John & Henry, 84 La Salle St.
Falkenau Construction Co., 110 La Salle St.
Freeman, Hart & Co., Chamber of Commerce.
Gindele, Chas. W., Co., 3333 La Salle St.
Grace, Wm. Company, 1408 Wabash Av.
Griffiths, John & Son, 1009-1011 Merchants Loan & Trust Bldg.
Johnson, F. O., 84 La Salle St.
Johnson & Stokes, 901 Security Bldg.
Lanquist & Illsley Co., 393 North Clark St.
Leafgreen Construction Co., 145 La Salle St.
Ledgerwood, A. J. C., Rooms 516-517, 184 La Salle St.
Mavor, William Co., 164 Dearborn St.
McCarty Brothers, 804, 134 Monroe St.
Meiling & Walther, 84 La Salle St.
Moe, Ingwald, 7627 Coles Av.
Morava Construction Co., 1243 Marquette Bldg. 204 Dearborn St.
Morrice & Barron, 125 La Salle St.
Mortimer & Tapper, 145 E. Van Buren St.
Mueller, Paul P. F., 109 Randolph St.
Nelson, F. P. & Son, 715-716 Cham. of Com.
O'Connor, J. P. and J. W., 807 Security Bldg.
Peterson, John & Co., 171 Washington St.
Scharmer, Jacob, 1007 Chamber of Commerce.
Schlueter, Henry W., 204 Dearborn St.
Snyder, H. V., 813 Chamber of Commerce.
Snyder, J. W., 316, 145 La Salle St.
Sollitt, Ralph & Sumner Co., 140 Dearborn St.
Sproul, Elliott W., 315 Chamber of Commerce.
Steel Stone Construction Co., 1761 Monadnock.
Strandberg, E. P. Company, 159 La Salle St.
Stresenreuter Bros., 614 Chamber of Commerce.
Thompson-Starrett Co., Railway Exc. Bldg.
Thomson, George & Son Co., 145 La Salle St.,
Truesdell, F. H., 4360 N. Clark St.
Todd, James, & Co., 145 La Salle St.
Union Building Material Co., 509 Chamber of Commerce.
Volkmann, Chas. & Co., 184 Dearborn St.
Wells Bros. Company, 1014 Monadnock Blk.
Wolfinger, Clarence L., 226 La Salle St.
Zadeck, B. M. Co., 811, 135 Adams St.

GENERAL HARDWARE.

Hodge & Homer Co., 47 and 49 W. Randolph.

GLASS.

American Luxfer Prism Co., 346 Wabash Av.

GLASS—ART, ORNAMENTAL AND STAINED.

American Luxfer Prism Co., 346 Wabash Av.
Helmerich, W. H. & Co., 151-153 Fulton St.
Linden Glass Co., 1216 Michigan Av.
Schuler & Mueller, Madison and Canal Sts.

GLASS—BEVELED.

American Luxfer Prism Co., 346 Wabash Av.
Helmerich, W. H. & Co., 151-153 Fulton St.
Schuler & Mueller, Madison and Canal Sts.

GLASS—CUT.

Helmerich, W. H. & Co., 151-153 Fulton St.
Schuler & Mueller, Madison and Canal Sts.

GLASS—MOSAIC.

Helmerich, W. H. & Co., 151-153 Fulton St.
Linden Glass Co., 1216 Michigan Av.
Schuler & Mueller, Madison and Canal Sts.

GLASS—PRISMATIC.

American Luxfer Prism Co., 346 Wabash Av.
Helmerich, W. H. & Co., 151-153 Fulton St.

GLASS—WIRE.

Mississippi Wire Glass Co., 1212 Tribune Bldg.

GRAIN ELEVATOR CONSTRUCTION.

Minneapolis Steel & Machinery Co., 622 Monadnock Blk.

GRAIN ELEVATOR MACHINERY.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Link Belt Machinery Co., 39th St. and Stewart Av.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

GRAIN ELEVATORS—ARCHITECTS AND CONTRACTORS.

Minneapolis Steel & Machinery Co., 622 Monadnock Blk.

GRANITE—CRUSHED.

American Crushed Stone Co., 92 La Salle St.

GRAPHITE PROTECTIVE COATINGS.

Chicago Graphite Mfg. Co., 649 Railway Exch.

GRATES.

Dawson Bros., 197-207 N. Halsted St.
Hoops, William H. & Co., 10-12 E. Monroe St.
Interior Woodworking Co., 296 Wabash Av.

GRATES FOR FIREPLACES.

Dawson Bros., 197-207 N. Halsted St.
Hoops, William H. & Co., 10-12 E. Monroe St.
Interior Woodworking Co., 296 Wabash Av.

GRAVEL.

Knickerbocker Ice Co., 171 La Salle St.

GRILLE WORK—METAL.

Landon & Eggers, Iron and Wire Works, Contracting Office, First National Bank Bldg.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, 810 Railway Exch

GRILLES.

Architectural Decorating Co., 643 S. Jefferson.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Decorators' Supply Co., The, 215 S. Clinton St.

HAIR FELT.

Chicago Fire Proof Covering Co., 18 N. Canal St.
Johns-Manville Co., H. W., 173 Randolph St.

HANGERS AND SHAFTING.

Street, R. R. & Co., 184-186 Washington St.

HARDWARE.

Orr & Lockett Hardware Co., 71-73 Randolph.

HARDWARE—BUILDERS'.

Chicago Hardware Co., 40 Dearborn St.
Orr & Lockett Hardware Co., 71-73 Randolph.

HARDWARE—MANUFACTURERS'.

Chicago Hardware Co., 40 Dearborn St.
Reading Hardware Co., 105 Lake St.
Russell & Erwin Mfg. Co., 22 East Lake St.

HARDWARE SPECIALTIES.

Chicago Hardware Co., 40 Dearborn St.
Reading Hardware Co., 105 Lake St.
Russell & Erwin Mfg. Co., 22 East Lake St.

HARDWOOD FLOORING.

Chandler Lumber Company, 100 Elston Av.
Cooley, Wm. H., 1160 Clybourn Ave.
Hayden & Lombard, 1303 Railway Exchange.
Hettler, Herman H. Lumber Co., 1324 Elston.
Rittenhouse & Embree Co., 3500 Center Av.
Spry, John Lumber Co., Ashland Av. & 22d St.
Wilce, T. Co., The, 22nd and Throop St.

HARDWOOD FLOORS.

Cooley, Wm. H., 1160 Clybourn Ave.
Dunfee, J. & Co., 55 N. Claremont Av.
Moore, E. B. & Co., 76 Wabash Ave.

HARDWOOD LUMBER.

Chandler Lumber Company, 100 Elston Av.
Hayden & Lombard, 1303 Railway Exchange.
Rittenhouse & Embree Co., 3500 Center Av.
Spry, John Lumber Co., Ashland Av. & 22d St.
Wilce, T. Co., The, 22nd and Throop St.

HEATERS.

Street, R. R. & Co., 184-186 Washington St.

HEATERS—COMBINATION.

International Heater Co., 48 Dearborn St.

HEATING APPARATUS.

American Engineering Specialty Co., 1510 Monadnock Blk.
Clow, James B. & Sons, Harrison & Franklin.
Coogan & Strothenke, Milwaukee, Wis.
Crane, M. H. Estate, 609 Security Bldg.
Davis Construction Co., 41 Dearborn St.
Deppmann, A. & Co., 212 Illinois St.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Graves, W. B., 45 E. Lake St.
Humphrey Co., Kalamazoo, Mich.
Illinois Malleable Iron Co., 30 W. Monroe St.
International Heater Co., 48 Dearborn St.
Kewanee Boiler Company, 167 Lake St.
Kroeschell Bros. Co., 55 Erie St.
Lewis & Kitchen, 433 Wabash Av.
McDonough, E. J. & Co., 25 North State St.
Monarch Water Heater Co., 230 E. 35th St., Chicago, and Pittsburg, Pa.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 79 Lake St.
Thomas & Smith, 17-19 S. Carpenter St.
Wilks, S. Mfg. Co., 35th St. & Shields Av.

HEATING SUPPLIES.

Clow, James B. & Sons, Harrison & Franklin.
Crane, M. H. Estate, 609 Security Bldg.
Davis, G. M. Regulator Co., 144-146 Milwaukee Av.
Davis Construction Co., 41 Dearborn St.
Illinois Malleable Iron Co., 30 W. Monroe St.
International Heater Co., 48 Dearborn St.
Kewanee Boiler Company, 167 Lake St.
Kroeschell Bros. Co., 55 Erie St.
Phillips-Getschow Co., 184 Indiana St.
Wilks, S. Mfg. Co., 35th St. & Shields Av.

HEATING AND VENTILATING.

American Engineering Specialty Co., 1510 Monadnock Blk.
Arcade Steam Heating Co., 70 La Salle Av.
Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Coogan & Strothenke, Milwaukee, Wis.
Crane, M. H. Estate, 609 Security Bldg.
Davis Construction Co., 41 Dearborn St.
Dilzer, Fred, 48 Dearborn St.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Graves, W. B., 45 E. Lake St.
Ideal Heating Co., 6312 Wentworth Av.
Kroeschell Bros. Co., 55 Erie St.
Lewis & Kitchen, 433 Wabash Av.
McDonough, E. J. & Co., 25 North State St.
Monarch Water Heater Co., 230 East 35th St., Chicago, and Pittsburg, Pa.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 79 Lake St.
Prentice, L. H. Company, 24-26 Sherman St.
Thomas & Smith, 17-19 S. Carpenter St.

HEATING AND VENTILATING—ENGINEERS.

Crane, M. H., Estate, 609 Security Bldg.

HECTOGRAPH PRINTS.

American Blue Print Paper Co., 102-104 Van Buren St. and Railway Exchange Bldg.
United States Blue Print Paper Co., 263 La Salle St.

HOISTING AND CONVEYING MACHINERY.

Hoisting & Conveying Machinery Co., The, 44-50 N. Elizabeth St.
Brown Hoisting Machinery, The, Cleveland, O
Jeffrey Mfg. Co., Monadnock Bldg. and Columbus, Ohio.
Link Belt Machinery Co., 39th St and Stewart Ave.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

HOT BLAST HEATING APPARATUS.

American Engineering Specialty Co., 1510 Monadnock Blk.
Arcade Steam Heating Co., 70 La Salle Av.
Coogan & Strothenke, Milwaukee, Wis.
Davis, G. M. Regulator Co., 144-146 Milwaukee Av.
Deppmann, A. & Co., 212 Illinois St.
Downey & Kruse Co., Milwaukee, Wis.
Phillips-Getschow Co., 184 Indiana St.
Prentice, L. H. Company, 24-26 Sherman St.

HOT WATER HEATERS.

American Engineering Specialty Co., 1510 Monadnock Blk.
Arcade Steam Heating Co., 70 La Salle Av.
Clow, James B. & Sons, Harrison & Franklin.
Coogan & Strothenke, Milwaukee, Wis.
Davis Construction Co., 41 Dearborn St.
Dilzer, Fred, 48 Dearborn St.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Illinois Malleable Iron Co., 30 W. Monroe St.
International Heater Co., 48 Dearborn St.
Kewanee Boiler Company, 167 Lake St.
Kroeschell Bros. Co., 55 Erie St.
Lewis & Kitchen, 433 Wabash Av.
McDonough, E. J. & Co., 25 North State St.
Monarch Water Heater Co., 230 East 35th St., Chicago, and Pittsburg, Pa.
Phillips-Getschow Co., 184 Indiana St.
Thomas & Smith, 17-19 S. Carpenter St.
Wilks, S. Mfg. Co., 35th St. & Shields Av.

HOT WATER AND STEAM HEATING.

Arcade Steam Heating Co., 70 La Salle Av.
Clow, James B. & Sons, Harrison & Franklin.
Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Coogan & Strothenke, Milwaukee, Wis.
Crane, M. H. Estate, 609 Security Bldg.
Deppmann, A. & Co., 212 Illinois St.
Dilzer, Fred, 48 Dearborn St.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Graves, W. B., 45 E. Lake St.
Ideal Heating Co., 6312 Wentworth Av.
Kroeschell Bros. Co., 55 Erie St.
Lewis & Kitchen, 433 Wabash Av.
McDonough, E. J. & Co., 25 North State St.
Nacey, P. Co., 315-317 Wabash Av.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 79 Lake St.
Prentice, L. H. Company, 24-26 Sherman St.
Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

HOUSE AND FIRE WRECKERS.

Benson, Barney & Son, 178-180 N. Green St.

HOUSE MOVERS AND RAISERS.

Neuses, Michael, 3879 N. Clark St.
Riendeau, L. J. & Son, 669 S. Talman Ave.
Sheeler, H., & Son, 716 Chamber of Commerce.

HYDRAULIC ELEVATORS.

Altizer & Prince Co., 51 Michigan St.
Eaton & Prince Co., 70-76 Michigan St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

HYGIENIC KALSOMINE.

Rubber Paint Company, 150-156 W. Van Buren.

ICE FACTORY AND REFRIGERATING PLANT SUPPLIES.

Featherstone Foundry & Machine Co., 348 N. Halsted St.

Vilter Mfg. Co., The, Milwaukee, Wis., and Monadnock Blk., Chicago.
Westerlin & Campbell Co., 53 and 55 S. Clinton.
Wolf, Fred W. Co., The, 139 Rees St.
York Mfg. Co., 1060 Monadnock Block.

ICE MAKING MACHINERY.

Featherstone Foundry & Machine Co., 348 N. Halsted St.
Vilter Mfg. Co., The, Milwaukee, Wis., and Monadnock Blk., Chicago.
Wolf, Fred W. Co., The, 139 Rees St.

ICE MAKING AND REFRIGERATING MACHINERY.

Featherstone Foundry & Machine Co., 348 N. Halsted St.
Vilter Mfg. Co., The, Milwaukee, Wis., and Monadnock Blk., Chicago.
Westerlin & Campbell Co., 53 and 55 S. Clinton.
Wolf, Fred W. Co., The, 139 Rees St.
York Mfg. Co., 1060 Monadnock Block.

INDUCED DRAFT REGULATORS.

Davis, G. M. Regulator Co., 144-146 Milwaukee Av.

INSPECTORS.

Hunt, Robert W. & Co., 1121 The Rookery.

INSTANTANEOUS WATER HEATERS—FOR BATHS—GAS OR GASOLINE.

Humphrey Co., Kalamazoo, Mich.
Monarch Water Heater Co., 230 East 35th St., Chicago, and Pittsburg, Pa.

INSULATING PAPERS.

Johns-Manville Co., H. W., 173 Randolph St.

INSULATION—BREWERIES AND COLD STORAGE WAREHOUSES.

Detroit Fireproofing Tile Co., 904 Ft. Dearborn Bldg. and Detroit, Mich.
Illinois Terra Cotta Lumber Co., 439 The Rookery.
National Fire Proofing Co., 806 Hartford Bldg.
Pioneer Fireproofing Co., 1515 Marquette Bldg.

INTERIOR DECORATORS.

Architectural Decorating Co., 643 S. Jefferson.
Carson, Pirie, Scott & Co. (Bureau of Equipment), State and Madison Sts.
Spierling & Linden, 1216 Michigan Av.

INTERIOR FINISH.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Davis, Reginald J. Co., The, Suite 1451, Railway Exchange Bldg.
Huether, Jacob, 247 Wells St.
Interior Woodworking Co., 296 Wabash Av.
Mears, Chas. H. & Co., 1103 Belmont Ave.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Warren, William H. Mfg. Co., Blackhawk St. and Smith Ave.
Wolfinger, Clarence L., 226 La Salle St.

INTERIOR MOLDINGS.

Moore, George F., 186-188-190 24th St.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.

INTERIOR VAULT CONSTRUCTION.

Krag Imperial Cabinet Co., Clinton & Monroe.

INTERLOCKING RUBBER TILE.

New York Belting & Packing Co., Ltd., 150 Lake St.

IRON DOORS AND SHUTTERS.

Benner Mfg. Co., 110 W. Monroe St.
Central Iron Works of Chicago, 263-265 West Lake St.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Horn, Wm. Structural Iron Works, 902 to 908 W. Lake St.
Kinnear Mfg. Co., The, 112 Clark St.
Landon & Egers, Iron and Wire Works, Contracting Office, First National Bank Bldg.
Muth, Chr., 428 Blue Island Av.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.

IRON FOUNDRIES.

Featherstone Foundry & Machine Co., 348 N. Halsted St.
Reder Foundry Co., 181-189 Newberry Av.
Walter, Wm. B. & Co., 545 Marquette Bldg.

IRON RAILINGS AND FENCES.

American Iron & Wire Wks, 575-581 Carroll Av.
Bolters, A. Sons, 84 La Salle St.
Booth, John, 14 and 16 N. Canal St.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Holmes, Pyott & Co., 13 N. Jefferson St.
Horn, Wm. Structural Iron Works, 902 to 908 W. Lake St.
Landon & Egers, Iron and Wire Works, Contracting Office, First National Bank Bldg.
Muth, Chr., 428 Blue Island Av.
Scaar, Frank & Co., 92-98 Eleventh St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Standard Company, The, 810 Railway Exch.
Union Foundry Works, First Nat'l Bank Bldg.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.

IRON ROOFS.

Morava Construction Co., 1243 Marquette Bldg., 204 Dearborn St.
Muth, Chr., 428 Blue Island Av.
Strobel, C. L., 1744-48 Monadnock Blk.

IRON SETTERS.

Volkmann, Chas. & Co., 184 Dearborn St.

IRON STAIRS.

American Iron & Wire Wks, 575-581 Carroll Av.
Benner Mfg. Co., 110 W. Monroe St.
Brown Bros. Mfg. Co., 22nd and Campbell Av.
Central Iron Works of Chicago, 263-265 West Lake St.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Landon & Eggers Iron and Wire Works; contracting Office, First National Bank Bldg.
Muth, Chr., 428 Blue Island Av.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, 810 Railway Exch.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.
Winslow Bros. Company, The, 368-408 Carroll Av.

IRON STORE FRONTS.

American Iron & Wire Wks, 575-581 Carroll Av.
Benner Mfg. Co., 110 W. Monroe St.
Brown Bros. Mfg. Co., 22nd and Campbell Av.
Central Iron Works of Chicago, 263-265 West Lake St.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Horn, Wm. Structural Iron Works, 902 to 908 W. Lake St.
Muth, Chr., 428 Blue Island Av.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Standard Company, The, 810 Railway Exch.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.
Winslow Bros. Company, The, 368-408 Carroll Av.

IRON WORK—ORNAMENTAL.

American Iron & Wire Wks, 575-581 Carroll Av.
Baldwin Brass Works, 232-234 S. Clinton St.
Benner Mfg. Co., 110 W. Monroe St.
Bolters, A. Sons, 84 La Salle St.
Booth, John, 14 and 16 N. Canal St.
Brown Bros. Mfg. Co., 22nd and Campbell Av.
Central Iron Works of Chicago, 263-265 West Lake St.
Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Holmes, Pyott & Co., 13 N. Jefferson St.
Landon & Eggers Iron & Wire Works, Contracting Office First National Bank Bldg.

Muth, Chr., 428 Blue Island Av.
Scaar, Frank & Co., 92-98 Eleventh St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Standard Company, The, 810 Railway Exch.
Union Foundry Works, First Nat'l Bank Bldg.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.
Winslow Bros. Company, The, 368-408 Carroll Av.

IRON WORK—STRUCTURAL.

Brown Bros. Mfg. Co., 22nd and Campbell Av.
Fridstein Construction Co., 930 Monadnock.
Globe Iron Works, 31-41 Indiana St.
Hickey, M. H., Wire & Iron Works, 54 Dearborn St.
Horn, Wm. Structural Iron Works, 902 to 908 W. Lake St.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Morava Construction Co., 1243 Marquette Bldg., 204 Dearborn St.
Scaar, Frank & Co., 92-98 Eleventh St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Strobel, C. L., 1744-48 Monadnock Blk.
Vanderpoel Co., The, 497-505 W. 22nd St.
Voss, Frederick, 617 to 621 Austin Av.

JAIL AND PRISON BUILDERS.

Bolters, A. Sons, 84 La Salle St.
Globe Iron Works, 31-41 Indiana St.
Halsted, Joseph, 388 W. Randolph St.
Hickey, M. H., Wire & Iron Works, 54 Dearborn St.
Holmes, Pyott & Co., 13 N. Jefferson St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Union Foundry Works, First Nat'l Bank Bldg.
Voss, Frederick, 617 to 621 Austin Av.

JOIST HANGERS.

Clark, W. J. Co., The, Salem, Ohio.

KALSOMINE.

Muralo Co., The, 24 Market St.
Rubber Paint Company, 150-156 W. Van Buren.

LATH—METAL AND WIRE.

Booth, John, 14 and 16 N. Canal St.
Cannonsburg Iron & Steel Co., Pittsburg, Pa.
General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Northwestern Expanded Metal Co., 790 Old Colony Bldg.
Roebling Construction Co., The, 906 Tribune Bldg.
Voss, Frederick, 617 to 621 Austin Av.
Wheeling Corrugating Co., 45-47 Lake St.

LAUNDRY DRYERS.

Chicago Clothes Dryer Works, 346-348 Wabash Av.
Nelson & Krueter Co., Spalding Av. and Bloomingdale Road; 49 S. Clinton St.

LAUNDRY MACHINERY.

Chicago Clothes Dryer Works, 346-348 Wabash Av.
Dawson, A. L. & Co., 27-29-31 W. Washington.
Nelson & Krueter Co., Spalding Av. and Bloomingdale Road; 49 S. Clinton St.

LAUNDRY MACHINERY SUPPLIES.

Nelson & Krueter Co., Spalding Av. and Bloomingdale Road; 49 S. Clinton St.

LAUNDRY TRAYS AND KITCHEN SINKS.

Alberene Stone Co., 56 N. Clinton St.

LEAD COATED IRON AND STEEL SHEETS FOR ROOFS, GUTTERS AND DOWN SPOUTS.

Ajax Lead Coating Co., The, 933 Marquette.

LEAD COATING.

Ajax Lead Coating Co., The, 933 Marquette.

LIME.

Meacham & Wright, 308-09 Chamber of Com.
Knickerbocker Ice Co., 171 La Salle St.
Ready & Gallaghan Coal Co., 47th and Halsted.

LINOLEUM AND OILCLOTHS.

Carson, Pirie, Scott & Co. (Bureau of Equipment), State and Madison Sts.

LINK BELTING.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Link Belt Machinery Co., 39th St. and Stewart Av.
Webster Mfg. Co., 1075 W. 15th St.

LOANS.

Baird & Warner, 90 La Salle St.
Greenebaum Sons, 83-85 Dearborn St.
Strauss, S. W. & Co., 114 La Salle St.

LOCKERS.

Dodge, H. B. & Co., 525-108 La Salle St.

LOCKERS—SHEET STEEL.

Churchill & Spalding, 464-478 Carroll Ave.

LUMBER.

Chandler Lumber Company, 100 Elston Av.
Hettler, Herman H. Lumber Co., 1324 Elston.
Hayden & Lombard, 1303 Railway Exchange.
Mears, Chas. H. & Co., 1103 Belmont Ave.
Paine Lumber Co., Chamber of Commerce.
Rittenhouse & Embree Co., 3500 Center Av.
Spry, John Lumber Co., Ashland Av. & 22d St.
Wilce, T. Co., The, 22nd and Throop St.

LUMBER—KILN DRIED.

Chandler Lumber Company, 100 Elston Av.
Rittenhouse & Embree Co., 3500 Center Av.
Spry, John Lumber Co., Ashland Av. & 22d St.
Wilce, T. Co., The, 22nd and Throop St.

LUMBER—YELLOW PINE—LONG LEAF.

Hettler, Herman H. Lumber Co., 1324 Elston.

MACHINISTS.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Contractors Supply & Equipment Co., Old Colony Bldg.
Featherstone Foundry & Machine Co., 348 N. Halsted St.
Hoisting & Conveying Machinery Co., The, 44-50 N. Elizabeth St.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbus, Ohio.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Link Belt Machinery Co., 39th St. and Stewart Av.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.
Westerlin & Campbell Co., 53 and 55 S. Clinton.
Wolf, Fred W. Co., The, 139 Rees St.
York Mfg. Co., 1060 Monadnock Block.

MACHINISTS' AND MANUFACTURERS' SUPPLIES.

Contractors Supply & Equipment Co., Old Colony Bldg.
Hodge & Homer Co., 47 and 49 W. Randolph.

MANTELS.

Dawson Bros., 197-207 N. Halsted St.
Hoops, William H. & Co., 10-12 E. Monroe St.
Interior Woodworking Co., 296 Wabash Av.

MANTELS—WOOD, BRICK AND TILE.

Dawson Bros., 197-207 N. Halsted St.
Hoops, William H. & Co., 10-12 E. Monroe St.
Interior Woodworking Co., 296 Wabash Av.

MARBLE WORKERS AND DEALERS.

Dawson Bros., 197-207 N. Halsted St.
Henry Marble Co., 3208 Shields Av.
Marthens, Chester N. Co., 747 First National Bank Bldg.
Sherman & Flavin, 2511 State St.

MASON CONSTRUCTORS.

Pittsburgh Construction Co., Diamond Bank Bldg., Pittsburgh, Pa.

MASON CONTRACTORS.

Angus Bros. & Co., 908 Security Bldg.
Bailey & Andrews, 411, 115 Dearborn St.
Campbell, Arch M. Co., 197 Madison St.
Clark C. Everett Co., 1405, 100 Washington St.
Cullen, Frank J., 617 Chamber of Commerce.
Eilenberger, H., & Co., 153 La Salle St.
Eriesson, John & Henry, 84 La Salle St.
Freeman, Hart & Co., Chamber of Commerce.
Gilbert, Harry S., 232 Lunt Av., Rogers Park.

Gindele, Chas. W., Co., 3333 La Salle St.
Grace, Wm. Company, 1408 Wabash Av.
Griffiths, John & Son, 1009-1011 Merchants Loan & Trust Bldg.
Johnson, F. O., 84 La Salle St.
Lanquist & Illsley Co., 393 North Clark St.
Leafgreen Construction Co., 145 La Salle St.
Ledgerwood, A. J. C., Rooms 516-517, 184 La Salle St.
Mayor, William Co., 164 Dearborn St.
McCarty Brothers, 804, 134 Monroe St.
Meiling & Walther, 84 La Salle St.
Morrice & Barron, 125 La Salle St.
Mortimer & Tapper, 145 East Van Buren St.
Mueller, Paul P. F., 109 Randolph St.
O'Connor, J. P. and J. W., 807 Security Bldg.
Peterson, John & Co., 171 Washington St.
Schlueter, Henry W., 204 Dearborn St.
Snyder, H. V., 813 Chamber of Commerce.
Snyder, J. W., 316, 145 La Salle St.
Sollitt, Ralph & Sumner Co., 140 Dearborn St.
Sproul, Elliott W., 315 Chamber of Commerce.
Strandberg, E. P. Company, 159 La Salle St.
Stresenreuter Bros., 614 Chamber of Commerce.
Thompson-Starrett Co., Railway Exc. Bldg.
Thomson, George & Son Co., 145 La Salle St.
Todd, James & Co., 145 La Salle St.
Wells Bros. Company, 1014 Monadnock Blk.
Zadeck, B. M. Co., 811, 135 Adams St.

MECHANICAL DRAUGHTSMEN.

Mayer, Geo. M., 1131 Monadnock Block.

METAL CEILINGS.

Bremer & Bielenberg, 1136 W. 13th St.
Keighley, S. Metal Ceiling Mfg. Co., Pittsburg, Pa.
Knisely Bros., 28th Place and 5th Av.
Wheeling Corrugating Co., 45-47 Lake St.

METAL CORNER BEAD.

Travers, Robert A., 540 Marquette Bldg.

METAL FURNITURE.

General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Krag Imperial Cabinet Co., Clinton & Monroe.

METAL INTERIOR DECORATIONS.

Illinois Roofing & Supply Co., 23 E. Lake St.
Wheeling Corrugating Co., 45-47 Lake St.

METAL LATH.

Cannonsburg Iron & Steel Co., Pittsburg, Pa.
General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Northwestern Expanded Metal Co., 790 Old Colony Bldg.
Scully Steel & Iron Co., Halsted & Fulton Sts.
Wheeling Corrugating Co., 45-47 Lake St.

METAL SASH AND FRAMES.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Voigtman & Company, 42-54 E. Erie St.

MILL WORK.

Mears, Chas. H. & Co., 1103 Belmont Ave.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Paine Lumber Co., Chamber of Commerce.

MILL AND ELEVATOR SUPPLIES.

Moore & Lorenz, 113-123 S. Clinton St.

MILL WORK—SASH, DOORS AND BLINDS.

Chicago Veneered Door Co., 316 Chamber of Commerce Bldg.
Mears, Chas. H. & Co., 1103 Belmont Ave.

MINERAL WOOL.

Chicago Fire Proof Covering Co., 18 N. Canal St.
Watson, H. F. Co., 12-14 S. Clinton St.

MODEL MAKERS.

Rabe, Otto, 16 N. Desplaines St.

MORTAR COLORS.

Kimbell, S. S., Brick Co., 304 Cham. of Com.

MORTGAGE LOANS.

Baird & Warner, 90 La Salle St.
Greenebaum Sons, 83-85 Dearborn St.
Strauss, S. W. & Co., 114 La Salle St.

MOSAICS.

Henry Marble Co., 3208 Shields Av.
Hoops, William H. & Co., 10-12 E. Monroe St.
Interior Woodworking Co., 296 Wabash Av.
Marthens, Chester N. Co., 747 First National Bank Bldg.
Sherman & Flavin, 2511 State St.

MOULDINGS.

Hettler, Herman H. Lumber Co., 1324 Elston.
Mears, Chas. H. & Co., 1103 Belmont Ave.
Moore, Geo. F., 186-188-190 24th St.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Paine Lumber Co., Chamber of Commerce.

MOULDINGS—DECORATIVE.

Moore, Geo. F., 186-188-190 24th St.

MOULDINGS—INTERIOR.

Moore, Geo. F., 186-188-190 24th St.

MOULDINGS—ROOM.

Moore, Geo. F., 186-188-190 24th St.

NATURAL GAS FITTING.

Nacey, P. Co., 315-317 Wabash Av.

OFFICE FITTINGS.

Davis, Reginald J. Co., The, Suite 1451, Railway Exchange Bldg.
Huether, Jacob, 247 Wells St.
Warren, William H. Mfg. Co., Blackhawk St. and Smith Ave.

OFFICE FURNITURE.

Stafford, E. H. Mfg. Co., 262-264 Wabash Ave.

OPERA CHAIRS.

Stafford, E. H. Mfg. Co., 262-264 Wabash Ave.

ORNAMENTAL IRON BANK AND OFFICE FIXTURES.

Chicago Ornamental Iron Works, 37th St. and Stewart Av.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Landon & Eggers, Iron and Wire Works, Contracting Office, First National Bank Bldg.
Smith, F. P. Wire & Iron Works, 100 Lake St.

ORNAMENTAL PATTERNS FOR METAL CASTINGS.

Dux, Joseph, 132 W. Jackson Blvd.

ORNAMENTAL TERRA COTTA.

American Terra Cotta & Ceramic Co., The, 602 Chamber of Commerce Bldg.
Northwestern Terra Cotta Co., The, 1415 Railway Exchange Bldg.

PACKING.

Jenkins Bros., 31 North Canal St.

PAINT—GRAPHITE.

Chicago Graphite Mfg. Co., 649 Railway Exch.
Lucas, John & Co., 55 N. Desplaines St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PAINT—IRON.

Chicago Graphite Mfg. Co., 649 Railway Exch.
Garden City Sand Co., The, 188 Madison St.
Lucas, John & Co., 55 N. Desplaines St.
Morgan, H. B. Company, Grand Crossing.
Picher Lead Co., 131 La Salle St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PAINT MILLS AND MACHINERY.

Kaestner, Chas. & Co., 241-261 S. Jefferson St.

PAINT—MIXED.

Chicago Graphite Mfg. Co., 649 Railway Exch.
Lucas, John & Co., 55 N. Desplaines St.
Muralo Co., The, 24 Market St.
Picher Lead Co., 131 La Salle St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PAINTERS' SUPPLIES.

Lucas, John & Co., 55 N. Desplaines St.
Muralo Co., The, 24 Market St.
Picher Lead Co., 131 La Salle St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 154-156 W. Van Buren.

PAINTS.

Chicago Graphite Mfg. Co., 649 Railway Exch.
Lucas, John & Co., 55 N. Desplaines St.
Muralo Co., The, 24 Market St.
Picher Lead Co., 131 La Salle St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PAINTS—COLD WATER.
Chicago Fire Proof Covering Co., 18 N. Canal St.
Johns-Manville Co. H. W., 173 Randolph St.
Lucas, John & Co., 55 N. Desplaines St.
Muralo Co., The, 24 Market St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PAINTS—DAMP RESISTING.
Garden City Sand Co., The, 188 Madison St.

PAINTS—FIREPROOF.
Muralo Co., The, 24 Market St.

PAINTS—ROOFING.
Bird, F. W. & Son, 1434 Monadnock Blk.
Callahan, Geo. C. & Co., 908 Tacoma Bldg.
Chicago Fire Proof Covering Co., 18 N. Canal St.
Lucas, John & Co., 55 N. Desplaines St.
McEvoy, Wm. P. & Co., 414 Reaper Block.
Morgan, H. B. Company, Grand Crossing.
Muralo Co., The, 24 Market St.
Pitkin, Geo. W. Co., Fulton & Carpenter Sts.
Rubber Paint Company, 150-156 W. Van Buren.

PARQUET FLOORS.
Cooley, Wm. H., 1160 Clybourn Ave.
Dunfee, J. & Co., 55 N. Claremont Av.
Moore, E. B. & Co., 76 Wabash Ave.

PATENT DRAUGHTSMEN.
Mayer, Geo. M., 1131 Monadnock Block.

PATENT MORTISE LOCKS.
Chicago Hardware Co., 40 Dearborn St.

PATTERN MAKERS.
Rabe, Otto, 16 N. Desplaines St.

PAVING CONTRACTORS.
American Crushed Stone Co., 92 La Salle St.

PAVING AND FLOORS.
McEvoy, Wm. P., & Co., 414 Reaper Blk.

PAVING MATERIALS.
American Crushed Stone Co., 92 La Salle St.

PHYSICAL LABORATORY.
Hunt, Robert W. & Co., 1121 The Rookery.

PILE DRIVERS.
Featherstone Foundry & Machine Co., 348 N. Halsted St.

PIPE AND BOILER COVERING.
Asbestos Mfg. & Supply Co., The, 1506 Fisher Bldg.
Chicago Fire Proof Covering Co., 18 N. Canal St.
Garden City Sand Co., The, 188 Madison St.
Johns-Manville Co., H. W., 173 Randolph St.
Watson, H. F. Co., 12-14 S. Clinton St.

PIPE AND FITTINGS.
Clow, James B. & Sons, Harrison & Franklin.

PLASTER.
Architectural Decorating Co., 643 S. Jefferson.
Decorators' Supply Co., The, 215 S. Clinton St.

PLASTER BOARDS.
Mackolite Fireproofing Co., 1401-03 Schiller Bldg.

PLASTER, ORNAMENTAL.
Architectural Decorating Co., 643 S. Jefferson.
Decorators' Supply Co., The, 215 S. Clinton St.

PLASTERING.
Heidorn, Wm. D. & Co., 1872 N. Ashland Av.
McNulty Bros., 1455 Railway Exchange Bldg.
Zander-Reum Co., 508 Lakeside Bldg.

PLASTERING CONTRACTORS.
Heidorn, Wm. D. & Co., 1872 N. Ashland Av.
McNulty Bros., 1455 Railway Exchange Bldg.
Zander-Reum Co., 508 Lakeside Bldg.

PLASTERING LATH.
Cannonsburg Iron & Steel Co., Pittsburg, Pa.
General Fireproofing Co., The, 315 Old Colony Bldg., Chicago; 212 Federal Bldg., Youngstown, Ohio.
Roebling Construction Co., The, 906 Tribune Bldg.
Voss, Frederick, 617 to 621 Austin Av.

PLASTERING MATERIAL.
Garden City Sand Co., The, 188 Madison St.
United States Gypsum Co., 200 Monroe St.

PLASTIC RELIEF.
Architectural Decorating Co., 643 S. Jefferson.
Decorators' Supply Co., The, 215 S. Clinton St.

PLUMBING, GASFITTING AND SEWERAGE.
Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Nacey, P. Co., 315-317 Wabash Av.
Wills & Smith, 5938 S. Halsted St.

PORTLAND CEMENT.
Garden City Sand Co., The, 188 Madison St.
Knickerbocker Ice Co., 171 La Salle St.
Mississippi Valley Portland Cement Co., The, First Nat'l Bank Bldg.
Whitehall Portland Cement Co., 172 East Washington St.

POST CAPS, ETC.
Clark, W. J. Co., The, Salem, Ohio.

POWER ENGINES.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.

POWER GENERATORS.
Fairbanks, Morse & Co., Franklin and Monroe.
Street, R. R. & Co., 184-186 Washington St.

POWER PLANTS.
Crane, M. H. Estate, 609 Security Bldg.
Graves, W. B., 45 E. Lake St.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.

POWER PUMPS.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Rider-Ericsson Engine Co., 40 Dearborn St.

POWER TRANSMISSION APPLIANCE.
Street, R. R. & Co., 184-186 Washington St.

POWER TRANSMISSION MACHINERY.
Caldwell, W. E. Co., Louisville, Ky.

PREPARED ROOFING MATERIAL.
Chicago Fire Proof Covering Co., 18 N. Canal St.

PRESSURE HEATING.
Davis, G. M. Regulator Co., 144-146 Milwaukee Av.

PULLEYS—STEEL.
Caldwell, W. E. Co., Louisville, Ky.
Street, R. R. & Co., 184-186 Washington St.

PULLEYS—WOOD.
Caldwell, W. E. Co., Louisville, Ky.

PUMPS.
Dawson, A. L. & Co., 27-29-31 W. Washington.
Fairbanks, Morse & Co., Franklin and Monroe.
Kroeschell Bros. Co., 55 Erie St.
Rider-Ericsson Engine Co., 40 Dearborn St.

PUMPS—AUTOMATIC AND HYDRAULIC.
Rider-Ericsson Engine Co., 40 Dearborn St.

PUMPING MACHINERY.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Rider-Ericsson Engine Co., 40 Dearborn St.

PURIFIERS—WATER.
New York Continental Jewell Filtration Co., 40-42 Quincy St.
Pittsburgh Filter Mfg. Co., Pittsburgh, Pa.

RADIATORS.
Arcade Steam Heating Co., 70 La Salle Av.
Clow, James B. & Sons, Harrison & Franklin.
Kroeschell Bros. Co., 55 Erie St.
Western Valve Co., 41-43 W. Randolph St.

RAILINGS AND GRILLES—BRASS.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.

RAILROAD SHOPS AND WAREHOUSES.
Pittsburgh Construction Co., Diamond Bank Bldg., Pittsburgh, Pa.

REAL ESTATE LOANS.
Baird & Warner, 90 La Salle St.
Greenebaum Sons, 83-85 Dearborn St.
Strauss, S. W. & Co., 114 La Salle St.

REFRIGERATING AND ICE MAKING MACHINERY.
Featherstone Foundry & Machine Co., 348 N. Halsted St.
Kroeschell Bros. Co., 55 Erie St.
Vilter Mfg. Co., The, Milwaukee, Wis., and Monadnock Blk., Chicago.
Westerlin & Campbell Co., 53 and 55 S. Clinton.
Wolf, Fred W. Co., The, 139 Rees St.

REFRIGERATORS.
McCray Refrigerator Co., 55 Wabash Ave., Chicago; Kendallville, Ind.
Orr & Lockett Hardware Co., 71-73 Randolph.

REGULATORS—DAMPER.

Davis, G. M. Regulator Co., 144-146 Milwaukee Av.

REGULATORS—HEAT, STEAM, AIR, WATER.

Davis, G. M. Regulator Co., 144-146 Milwaukee Av.

ROLLING PARTITIONS—WOOD AND STEEL.

Dodge, H. B. & Co., 525, 108 La Salle St.

ROOFING AND SIDING.

Illinois Roofing & Supply Co., 23 E. Lake St.

ROOFING.

Bremer & Bielenberg, 1136 W. 13th St.
Callahan, Geo. C. & Co., 908 Tacoma Bldg.
Ford Mfg. Co., 109 West Washington St.
Johns-Manville Co., H. W., 173 Randolph St.
Knisely Co., Harry C., 273 S. Canal St.
Murdoch, William Co., 145 La Salle St.
National Roofing Co., 3223 La Salle St.
Patent Vulcanite Roofing Co., 625-659 South Campbell Ave.
Powell, M. W. Co., 204 Dearborn St.
Randolph, C. W., 825 Clifton Av.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

ROOFING—ASBESTOS.

Chicago Fire Proof Covering Co., 18 N. Canal St.
Johns-Manville Co., H. W., 173 Randolph St.

ROOFING—CORRUGATED IRON.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.
McFarland, J. C. & Co., 27th St. and 5th Av.
Miller, James A. & Bro., 129 S. Clinton St.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.
Wheeling Corrugating Co., 45-47 Lake St.

ROOFING—GENERAL.

Ford Mfg. Co., 109 West Washington St.
Murdoch, William Co., 145 La Salle St.
National Roofing Co., 3223 La Salle St.
Powell, M. W. Co., 204 Dearborn St.

ROOFING—GRAVEL.

Murdoch, William Co., 145 La Salle St.
National Roofing Co., 3223 La Salle St.
Powell, M. W. Co., 204 Dearborn St.
Randolph, C. W., 825 Clifton Av.

ROOFING MATERIALS.

Ford Mfg. Co., 109 West Washington St.
Garden City Sand Co., The, 188 Madison St.
Johns-Manville Co., H. W., 173 Randolph St.
Murdoch, William Co., 145 La Salle St.
National Roofing Co., 3223 La Salle St.
Patent Vulcanite Roofing Co., 625-659 South Campbell Ave.
Powell, M. W. Co., 204 Dearborn St.
Randolph, C. W., 825 Clifton Av.
Watson, H. F. Co., 12-14 S. Clinton St.

ROOFING PAINTS.

Johns-Manville Co., H. W., 173 Randolph St.
Morgan, H. B. Company, Grand Crossing.

ROOFING PAPER.

Ford Mfg. Co., 109 West Washington St.
Johns-Manville Co., H. W., 173 Randolph St.
Patent Vulcanite Roofing Co., 625-659 South Campbell Ave.
Watson, H. F. Co., 12-14 S. Clinton St.

ROOFING SLATE.

Travers, Robert A., 540 Marquette Bldg.

ROOFING—SLATE AND TILE.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Co., Harry C., 273 S. Canal St.
McFarland, J. C. & Co., 27th St. and 5th Av.
Miller, James A. & Bro., 129 S. Clinton St.
Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

ROOFING—TEN-YEAR GUARANTEE.

Murdock, William, Co., 145 La Salle St.

ROOFING TILE—DEALERS.

American Clay Products Co., 514, 142 Washington St.
Globe Roofing Tile Co., 723, 218 La Salle.

ROOFING TIN.

American Sheet & Tin Plate Co., Pittsburg, Pa.; Rookery Bldg., Chicago; Battery Park Bldg., New York; Union Trust Bldg., Cincinnati; Ainsworth Blk., Portland, Ore.; Henen Bldg., New Orleans; Equitable Bldg., Denver; Mills Bldg., San Francisco; Security Bldg., St. Louis.

ROOFING—TIN PLATE.

Wheeling Corrugating Co., 45-47 Lake St.

ROOFING—TIN, SLATE, TILE AND METAL.

Bremer & Bielenberg, 1136 W. 13th St.
Knisely Bros., 28th Place and 5th Av.
Knisely Co., Harry C., 273 S. Canal St.

ROOM MOLDINGS.

Moore, George F., 186-188-190 24th St.

ROPE TRANSMISSION MACHINERY.

Brown Hoisting Machinery Co., The, Cleveland, Ohio.
Caldwell, W. E., Co., Louisville, Ky.
Jeffrey Mfg. Co., Monadnock Bldg., and Columbns, Ohio.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Link Belt Machinery Co., 39th St. and Stewart Av.
Webster Mfg. Co., 1075 W. 15th St.
Weller Mfg. Co., 118 East North Ave.

RUBBING BEDS—MARBLE WORKERS'.

Featherstone Foundry & Machine Co., 348 N. Halsted St.

RUBBER—MOULDED.

Delaware Hard Fibre Co., 108-110 La Salle St.

RUBBER TILE.

New York Belting & Packing Co., Ltd., 150 Lake St.

RUBBER TILING.

Delaware Hard Fibre Co., 108-110 La Salle St.

RUBBER TILING—FLOORS FOR ELEVATORS AND PUBLIC PLACES.

Delaware Hard Fibre Co., 108-110 La Salle St.
New York Belting & Packing Co., Ltd., 150 Lake St.

SAFES.

Harris, S. H. Co., The, 29 Pearce St.
Herring-Hall-Marvin Safe Co., corner Dearborn and Lake Sts.

SAFES—BANK.

Harris, S. H. Co., The, 29 Pearce St.
Herring-Hall-Marvin Safe Co., corner Dearborn and Lake Sts.

SAFETY DEPOSIT VAULTS.

Chamber of Commerce Safety Vault Co., Chamber of Commerce, 132 Washington St.

SAND.

American Crushed Stone Co., 92 La Salle St.
Garden City Sand Co., The, 188 Madison St.
Knickerbocker Ice Co., 171 La Salle St.
Krng, S., 167 Dearborn St.
Lake Shore Sand Co., 308 Chamber of Com.
Ready & Gallaghan Coal Co., 47th and Halsted.

SAND AND GRAVEL.

American Crushed Stone Co., 92 La Salle St.
Garden City Sand Co., The, 188 Madison St.
Knickerbocker Ice Co., 171 La Salle St.
Lake Shore Sand Co., 308 Chamber of Com.
Ready & Gallaghan Coal Co., 47th and Halsted.

SAND-LIME BRICKS AND BLOCKS.

Huennekes, H. Co., 660 Monadnock Blk.

SASH CORD.

Samson Cordage Works, 115 Congress St., Boston, Mass.

SASH, DOORS AND BLINDS.

Mears, Chas. H. & Co., 1103 Belmont Ave.
Nollau & Wolff Mfg. Co., 35-45 Fullerton Ave.
Paine Lumber Co., Chamber of Commerce.
Spry, John Lumber Co., Ashland Av. & 22d St.

SCAGLIOLA.

Henry Marble Co., 3208 Shields Av.

SCALES.

Fairbanks, Morse & Co., Franklin and Monroe.

SCHOOL FURNITURE.

Stafford, E. H. Mfg. Co., 262-264 Wabash Ave.

SEAMLESS WROUGHT STEEL TUBES.

Seamless Tube Co. of America, 36 La Salle St., Chicago, and Pittsburg, Pa.

SECURITY BONDS FOR CONTRACTORS.

Burrows, Marsh & McLennan, 159 La Salle St.

SEPARATORS—STEAM AND OIL.

American Engineering Specialty Co., 1510 Monadnock Blk.

SEWER BUILDERS—PUBLIC AND PRIVATE.

Nacey, P. Co., 315-317 Wabash Av.

SEWER CASTINGS.

Walter, Wm. B. & Co., 545 Marquette Bldg.

SEWER PIPE.

Dee, Wm. E. Co., 214 and 215 Royal Ins. Bldg.

SHEATHING PAPER.

Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.
Johns-Manville Co., H. W., 173 Randolph St.
Watson, H. F. Co., 12-14 S. Clinton St.

SHELVES—STEEL FOR FACTORIES.

Churchill & Spalding, 464-478 Carroll Ave.
Krag Imperial Cabinet Co., Clinton & Monroe.

SHINGLES.

Chandler Lumber Company, 100 Elston Av.
Hettler, Herman H. Lumber Co., 1324 Elston.

SHINGLE STAINS.

Cabot, Samuel, 28 Dearborn Ave. and Boston, Mass.
Johns-Manville Co., H. W., 173 Randolph St.
Lucas, John & Co., 55 N. Desplaines St.

SIDEWALK BUILDERS.

Blome, Rudolph S. Co., 79 Dearborn St.
Brown, F. E. & Co., 1007 Chamber of Com.
de Smet, Geo. W., Chamber of Commerce.
Gilbert, Harry S., 232 Lunt Av., Rogers Park.
Hoeffer & Co., Chamber of Commerce Bldg.
McEvoy, Wm. P. & Co., 414 Reaper Block.
Peterson, John & Co., 171 Washington St.
Simpson Construction Co., 704 Cham. of Com.

SIDEWALK AND VAULT LIGHTS.

American Luxfer Prism Co., 346 Wabash Av.
Brown Bros. Mfg. Co., 22nd and Campbell Av.

SKYLIGHTS.

Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

SLATE DEALERS.

Voigtmann, Frank, Cornice Co., 129 N. Franklin St.

SLATE FOR ROOFING.

Travers, Robert A., 540 Marquette Bldg.

SLATE—STRUCTURAL.

Travers, Robert A., 540 Marquette Bldg.

SMOKELESS FURNACES.

Kroeschell Bros. Co., 55 Erie St.

SMOKESTACKS.

Heil Rail Joint Welding Co., The, 414-416 Poplar St., Milwaukee, Wis.

STABLE FIXTURES—WIRE AND IRON.

American Iron & Wire Wks, 575-581 Carroll Av.
Benner Mfg. Co., 110 W. Monroe St.
Booth, John, 14 and 16 N. Canal St.
Central Iron Works of Chicago, 263-265 West Lake St.
Hickey, M. H. Wire & Iron Works, 54 Dearborn St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

STAINED SHINGLES.

Hettler, Herman H. Lumber Co., 1324 Elston.

STAIR WORK.

Davis, Reginald J. Co., The, Suite 1451, Railway Exchange Bldg.
Warren, William H. Mfg. Co., Blackhawk St. and Smith Ave.

STAIRS AND RAILINGS.

Davis, Reginald J. Co., The, Suite 1451, Railway Exchange Bldg.
Warren, William H. Mfg. Co., Blackhawk St. and Smith Ave.

STAND PIPES.

Benner Mfg. Co., 110 W. Monroe St.
Central Iron Works of Chicago, 263-265 West Lake St.
Kroeschell Bros. Co., 55 Erie St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

STATUARY—METAL.

Booth, John, 14 and 16 N. Canal St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Winslow Bros. Company, The, 368-408 Carroll Av.

STEAM BOILERS.

Kewanee Boiler Company, 167 Lake St.

STEAM ELEVATORS.

Altizer & Prince Co., 51 Michigan St.
Eaton & Prince Co., 70-76 Michigan St.
Otis Elevator Company, 9 Jackson Blvd.
Reedy, J. W. Elevator Mfg. Co., 91 Illinois St.

STEAM ENGINES AND BOILERS.

Fairbanks, Morse & Co., Franklin and Monroe.

STEAM FITTERS AND MACHINISTS.

Coogan & Strothenke, Milwaukee, Wis.
Crane, M. H. Estate, 609 Security Bldg.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Kroeschell Bros Co., 55 Erie St.
McDonough, E. J. & Co., 25 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 79 Lake St.

STEAM FITTERS' MATERIAL.

Davis, G. M. Regulator Co., 144-146 Milwaukee Av.
Marsh, Jas. & Co., 226 Washington St.

STEAM GENERATORS.

Kewanee Boiler Company, 167 Lake St.
Wilks, S. Mfg. Co., 35th St. & Shields Av.

STEAM HEATING APPARATUS.

Clow, James B. & Sons, Harrison & Franklin.
Conlin, Thomas, Plumbing & Heating Co., 3978 Cottage Grove Av.
Coogan & Strothenke, Milwaukee, Wis.
Crane, M. H. Estate, 609 Security Bldg.
Davis, G. M. Regulator Co., 144-146 Milwaukee Av.
Davis Construction Co., 41 Dearborn St.
Deppmann, A. & Co., 212 Illinois St.
Dilzer, Fred, 48 Dearborn St.
Douglas, Thos. J. & Co., 52 Dearborn St.
Downey & Kruse Co., Milwaukee, Wis.
Graves, W. B., 45 E. Lake St.
Ideal Heating Co., 6312 Wentworth Av.
Illinois Malleable Iron Co., 30 W. Monroe St.
Kroeschell Bros. Co., 55 Erie St.
McDonough, E. J. & Co., 25 North State St.
Norton, F. J., 8 North State St.
Phillips-Getschow Co., 184 Indiana St.
Pope, William A., 79 Lake St.
Thomas & Smith, 17-19 S. Carpenter St.
Wills & Smith, 5938 S. Halsted St.

STEAM PUMPING MACHINERY.

Fairbanks, Morse & Co., Franklin and Monroe.

STEAM TRAPS.

Marsh, Jas. & Co., 226 Washington St.
Western Valve Co., 41-43 W. Randolph St.

STEEL ROLLING DOORS, SHUTTERS AND PARTITIONS.

Dodge, H. B. & Co., 525, 108 La Salle St.
Kinnear Mfg. Co., The, 112 Clark St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
Voss, Frederick, 617 to 621 Austin Av.

STEEL TANKS.

Heil Rail Joint Welding Co., The, 414-416 Poplar St., Milwaukee, Wis.
Stoddard, Charles F., 52 Dearborn St.

STONE—BRIDGE.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.
Perry-Matthews-Buskirk Stone Co., Monadnock Block.

STONE—BUILDING.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.
Perry-Matthews-Buskirk Stone Co., Monadnock Block.

STONE DEALERS.

Bedford Quarries Co., The, Room 638, 204 Dearborn St.
Perry-Matthews-Buskirk Stone Co., Monadnock Block.

STONE DEALERS—IN ROUGH AND SAWED STONE.

Buscher & Gast, 3333 N. Clark St.
Chicago Cut Stone Co., 3403 La Salle St.

STORE AND OFFICE FIXTURES.

Conran, Thomas & Co., 49 Plymouth Place.

STOVES AND RANGES.

Detroit Stove Works, 2921 to 2933 S. La Salle St., Chicago, Ill.

STRUCTURAL IRON AND STEEL.

Bolters, A. Sons, 84 La Salle St.
Fridstein Construction Co., 930 Monadnock.
Globe Iron Works, 31-41 Indiana St.
Heil Rail Joint Welding Co., The, 414-416 Poplar St., Milwaukee, Wis.
Holmes, Pyott & Co., 13 N. Jefferson St.
Illinois Steel Company, 50 Wabansia Av.
Minneapolis Steel & Machinery Co., 622 Monadnock Blk.
Morava Construction Co., 1243 Marquette Bldg., 204 Dearborn St.
Smith, F. P. Wire & Iron Works, 100 Lake St.
South Halsted St. Iron Works, 135 Adams St.
Union Foundry Works, First Nat'l Bank Bldg.

SURVEYORS—CITY AND COUNTY.

Greeley-Howard Co., 822, 112 Clark St.

SURVEYORS' SUPPLIES.

Dietzgen, Eugene Co., 181 Monroe St.

TANKS—GALVANIZED STEEL.

Caldwell, W. E. Co., Louisville, Ky.

TANKS—IRON AND STEEL.

Fairbanks, Morse & Co., Franklin and Monroe.
Heil Rail Joint Welding Co., The, 414-416 Poplar St., Milwaukee, Wis.
Kaestner, Chas. & Co., 241-261 S. Jefferson St.
Kewanee Boiler Company, 167 Lake St.
Kroeschell Bros. Co., 55 Erie St.
Wilks, S. Mfg. Co., 35th St. & Shields Av.

TANKS—NICKEL PLATERS.

Alberene Stone Co., 56 N. Clinton St.

TANKS—STEEL GRAIN STORAGE.

Caldwell, W. E. Co., Louisville, Ky.

TANKS—STEEL WATER.

Caldwell, W. E. Co., Louisville, Ky.

TANKS—WOOD.

Caldwell, W. E. Co., Louisville, Ky.

TEMPERATURE REGULATORS.

Illinois Malleable Iron Co., 30 W. Monroe St.

TERRA COTTA.

American Terra Cotta & Ceramic Co., The, 602 Chamber of Commerce Bldg.
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TIMBER CONSTRUCTION.

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TURN TABLES.

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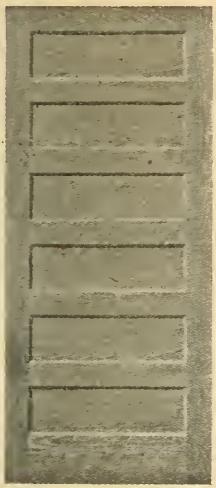

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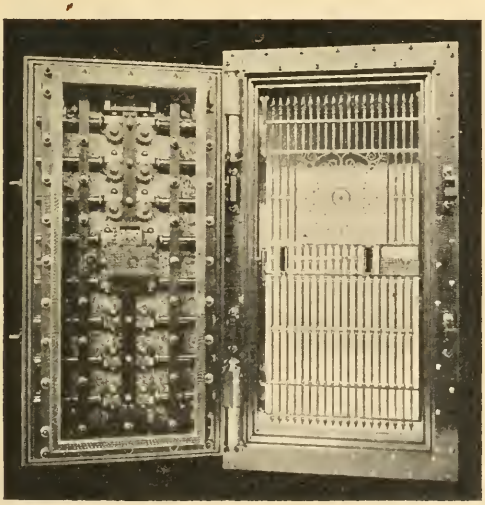

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